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SOME RESPONSIBILITIES OF SCIENCE WITH RELATION TO GOVERNMENT[1]

By Dr. JOHN C. MERRIAM

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AT this particular moment in history necessity for judgment on emergency questions has brought engineering, science and constructive work in sociology into important relation to government. Whatever views we may hold regarding the significance of scientific contributions in the present situation, this is a time in which questions touching the responsibilities of science to government can be discussed with hope that attention directed to the subject may aid ultimately in advancing understanding of this relation.

OBJECTIVES OF SCIENCE COMPARED WITH THOSE OF GOVERNMENT

Although science and the scientific method have become almost the controlling factors in certain great organized activities, as in some aspects of industry, the mode of operation of science has seemed commonly to differ sharply from that of government. Fundamentally, science relates to search for realities and principles and to their interpretation. It is the discoverer and organizer of facts. Science may also be creative, but commonly it is the inventor, engineer and artist who produce that which has not previously existed. Government is a form of organization or administration designed to make it possible for human beings to work together with mutual advantage. Its operations must be based upon realities or the truth, but their basic objective is the furnishing of means for bringing about relations among people which, according to current views of democracy, will give the maximum contribution of power or strength or wisdom for the whole group, and at the same time the

[1] Address at the General Session of the American Association for the Advancement of Science, Berkeley, California, June 20, 1934.

highest degree of individual liberty consistent with such organization.

Though fully effective government must be organized on the basis of facts and of those principles which can be demonstrated to represent the best interests of the people, often control is by brute force, by influence of money, or by many other kinds of power. Or government may be through control by types of propaganda representing ideas imposed upon thought of the people. Some of these suggestions may represent the truth, and others may be far from correct. Whether or no we recognize such government as legitimate, it may nevertheless be a foundation upon which much of human organization rests.

Again, it is necessary to realize that a government by the people will be what the people desire to have it, regardless of our specific views as to what it ought to be. Ability of leadership to accept such situations, and still in some measure furnish guidance, may be an important element, and yet be difficult to measure according to standards of scientific evaluation.

The problem of human organization or government must then be looked upon as representing a group of objectives quite different from those commonly visualized by the scientist. But in spite of this difference, it is important to emphasize the idea that ultimately in conduct of its affairs government rests upon elements which may be subject to investigation through the modes of approach used by science in search for the truth. Seen in this light, the responsibility of science may appear very large with reference to problems which relate to government.

As the term science is commonly understood, there has been much difference of opinion concerning the extent to which we may reach from this field into the region of human interests represented in government. From my own point of view, while science will deal in large part with elements which concern the natural world, it must be looked upon as representing an attitude of mind rather than the study of particular types of material. What has been called the natural history of man, illustrated in anthropology and psychology, extends into a great variety of peculiarly human problems. It expresses itself in another way in the type of historical research represented by archeology, paleontology and geology, presenting the evolution of man and his cultures. So far, then, as one can follow the study of human kind by use of methods which determine realities, and the relations between such real materials or states, we may look upon science as reaching into the investigation of human relations, even touching the field of government.

So, in the American Association for the Advancement of Science we have divisions of the organization concerned with human questions so intimately that we recognize overlap of the natural and social sciences spreading into the field of economics, and even including problems which would be called governmental.

Relation of Advance in Science to Evolution in Social and Governmental Activities

In viewing the relation of science to government from another angle, it is interesting to consider the achievements and progress in these two fields. The average estimates on rate of advance in knowledge have been assumed to indicate that science is the outstanding human activity of this time. That a wide road has been broken through boundaries which once marked the limits of knowledge regarding the natural world is clearly true. Extension of scientific thought taking us out in space to remote nebulae, into the minutiae of matter in the atom, and back in time to periods earlier than the date of man's creation, makes it impossible to avoid the view that science has entered wholly new worlds.

But great as are the achievements of science, we must realize that over long ages mankind has been moving forward in the work of constructing a stupendous and complicated organization which makes it possible for human beings to live and work together. Through this striving there has been developed in government a means for adapting individuals to each other which is perhaps the outstanding accomplishment of the human race. In spite of views which we as scientists possibly hold, government, with all its weaknesses, may represent the most important contribution of human experience up to the present time. But since government is not yet shown to be wholly scientific, and science is not yet fully adapted to government, the problem of the moment concerns means by which continuing development in forms of organization and administration essential for well-being of the community may be given the support which should come from constructive efforts through science.

In consideration of this particular question it is desirable to ask whether the contributions of science toward solution of social, economic and governmental questions may aid in opening the way for new types of advance in governmental organization. May we expect further movement in the fields of human research corresponding to that widening of vision and deepening of thought which were made possible in the natural sciences through construction of the microscope, telescope and theories like those expressed in the developmental or evolutionary view of life?

The almost infinite complexity of human affairs as compared with situations in most problems of natural science indicates that a restatement or reorganization or redevelopment of social, economic and governmen-

tal science comparable to what has occurred in natural science will probably take place only through effort vastly greater than that which made modern scientific advance possible.

Further development of government will show, among other critical features, that we need to consider human attitudes as they are encountered, though we may not justify them on the basis of scientific judgment. In examination of the factors involved in many great human problems there must be recognition of states of being and points of view for what they are, even if the conditions do not seem to fit completely into categories set up on the basis of facts and logic as we have catalogued and interpreted them in natural science. The emotional features of human beings and their individual independence increase the difficulty greatly. And yet it seems within the bounds of possibility that further great advances in evolution of government may occur, corresponding to those in our knowledge of the natural world around us. It is a part of the responsibility of science to consider the extent to which cooperation with investigators devoted to problems of government may facilitate such advance.

Education in Science as Related to Development of Initiative and to Quality of Judgment on Fundamental Problems of Government

One of the most critical questions touching the value of science in its relation to public affairs concerns the possible influence of the scientific attitude upon development of initiative and upon the quality of judgments required in solution of many new types of problems fundamental in government.

Future students of our political organization may be able to determine the extent to which ability to obtain and to maintain political power is correlated with capacity for solving great questions of the commonwealth. The natural development of government will presumably bring us increasingly close correlation between these two kinds of ability. The modification may come through bettered education of the people. Over the centuries the ultimate effectiveness of any government of the type which we support depends upon the capacity, the interest in critical questions and the point of view of the citizens. Though great leaders arise, in general the judgment of an educated citizenry will determine the nature of authority of government and the levels which it may reach.

While attempting to develop a governmental organization giving advantages of strength for the whole group, we endeavor to maintain freedom of thought and initiative. Whatever else is controlled, our religious views, our ideals and the opportunities for constructive work must be free from domination by central authority.

In development of the highest type of citizenship, inquiry and initiative are essential. This attitude represents precisely the point of view taken by science and research, which must rest upon and grow out of inquiry and initiative. Through the field of education, scientific subjects should have large ultimate influence upon the manner of thought of the people, and therefore upon government. Development of the attitude of mind which they illustrate is essential in maintenance of a democracy. If democracy represents the people, its roots must be in the people, and this involves ideas and attitudes as well as other things assumed to be more clearly defined.

As science, research and constructive thinking have developed in America, much of great significance has arisen within departments set up by the government. It is to be hoped that governmental policies will lean toward even greater extension of aid both to fundamental research and to its application. And yet, we must expect in the future, as in the past, that the sources of scientific initiative, like the sources of governmental authority, will arise from the people under a great variety of conditions and in institutions and localities as widely spread as are the boundaries of the country.

Non-governmental agencies representing a broad range of public interests, such as the Commonwealth Club, of San Francisco, are critically important sources of initiation and development of thought. Especially is this true of social and governmental questions. The research activities in organizations of this and of very many other types have a fundamental and far-reaching influence on the development of inquiry and initiative, and ultimately upon public judgment.

Fundamental Science in Governmental Programs

In study of great problems with which the government may concern itself, as in development of the present soil erosion program, or of study on land use, or in many other comparable questions, it is necessary to distinguish those elements which have to do with basic scientific factors from others which have been defined in terms of social, business or administrative values. Continuing development in our understanding of these major scientific questions will depend upon increasing knowledge of underlying principles. It is the responsibility of science to give its clearest thought and strongest effort to definition of these principles and to their intensive study.

It is necessary also to appreciate the fact that in contrast to what have been recognized as scientific elements, no program of this nature can be carried forward unless there is clear recognition of the interests and desires or aspirations of the people concerned. For example, adequate land use is dependent upon what the people of the country or the world desire to do. If, as illustration, it is believed that primitive natural beauty has an important place in development of the ideals and interests of mankind, then it is essential that there be clear definition of the purposes involved and that provision be made for protection and use of such features or areas. If it is believed that mankind should outgrow the influence of that natural beauty which existed in the world as it was made, and develop into what might be considered a higher state of living, then primitive nature should be disregarded.

In study of great problems clearly of national interest, such as weather prediction, basic scientific research will continue to be one of the most important contributing elements. The information may be related to extent of variation in radiation from the sun, or the nature of physical phenomena involved in atmospheric movements. Or the necessary scientific data may concern the form of the earth and the influence of land features upon movements of air and water. There is no case which seems to indicate greater need for correlation and integration of results derived from many sources than in that touching acquaintance with the climate and weather, and prediction of their moods or changes. For investigation of such questions it is important that science give its fullest aid wherever and whenever assistance is possible. The breadth of the foundation from which science and its application must build is indicated in the necessity for international cooperation in study of climate and weather.

It is well known that in no application of science is the need greater for aid of government to the people and for contribution of science to meet needs of government than in questions touching development of agriculture. The fact that cultivation of plants in a multitude of ways will always be possible as individual projects on a small scale, means that much-needed application of constructive effort through science will in considerable measure be conducted by the whole people or the government. But the vast difficulties of research in the fundamentals of such subjects as genetics, photosynthesis, the chemistry and physics of plant biology and the influence of environment upon variation are so great that the contribution of all available research must be given to aid governmental agencies if the largest measure of success is to be attained.

SCIENCE AND THE PROBLEM OF PLANNING

The train of events reaching from the world war into the recent depression having given exceptional stimulus to study of national and world problems, one product of this discussion has been the exceptional development of planning. On one hand are proposals which would hold society to rigorously defined programs laid out by government. In other directions are modes of organization intended to increase liberty of the individual. Whatever the ultimate result, we are now considering the responsibilities of each generation for taking stock of assets and opportunities, and for such a forward look as is of advantage now and for later years. While it is not to be expected that a completely adequate program will be developed immediately, it is of great significance that we begin to recognize clearly that there is a future and that we have relation to it.

It is possible that some of the most important relations of science to government will touch this field of planning. The great study on "Recent Social Trends," carried out by a committee under the chairmanship of Herbert Hoover, contributed in an exceptional way to fundamental materials required in consideration of planning programs. It is important that information in the field of science be examined with reference to its possible value in study of major national or governmental projects.

A wide view over the materials of science and history indicates, I believe, that until we know the past, its processes and experience, we shall not be equipped completely for satisfactory planning. The scientific study of history, with its stages of archeology, extending into early records of the earth and of life, is essential in such a program. Only a people acquainted with the basic meaning of history in the sense of the longer reaches of time, as well as with broad international relations, can make adequate judgments on overshadowing world problems such as face us at the moment. Ingrowing nationalism, which tends to neglect the world, both geographically and historically, is accentuated by lack of perspective.

If available methods of education in history do not give us the needed illumination, I shall hope to see more works like H. G. Wells' book of several decades ago on "The Discovery of the Future," based upon results from scientific and historical study of the past. Perhaps one should say that to-day the prophet is not without honor save when he stays so much in his own country, or thinks so much of his own region and day in history, that he does not know the world either in space or in time. So the relation of science to government may be critically important in that group of functions which concern the forward look as based upon the experience of history.

As bearing upon future relations of science to government in the study of planning activities, one may not avoid calling attention to the probability that the materials of science will continue to increase at a rate not greatly different from that of recent decades. Especially in planning programs is it important that new material be taken into consideration. It is therefore necessary to have increasingly close touch between scientific research groups and agencies of the government concerned with activities of the forward-looking or planning type.

CONCLUSIONS

There is no responsibility of science relating to the future of the country greater than that which concerns development of such an interest in scientific truth and realities on the part of the people as is needed to guarantee that the highest values in life ultimately prevail. In this relation the specific responsibility of scientific agencies is very large. This will be met:

First, by increasing emphasis upon the most fundamental types of investigation for the advancement of knowledge in every department.

Second, by bettered means for interpretation of science and for education of the people as a whole regarding the status of scientific knowledge. In part this work must be done by scientists themselves.

Third, by improved means for securing application of results from science, and at the same time better control of materials secured but not at once applied.

One of the ultimate cautions to be expressed in considering the rôle of science concerns recognition of the fact that, although essentially science represents certain aspects of truth and reality, there are other phases of human interest, as in art and our fundamental philosophical and religious beliefs, which may be looked upon as having meaning at least comparable in importance to science. While it is necessary for us to define the realities and the truths represented by science, the elements sometimes called human values are realized largely through appreciation of what is involved by use of other coordinate or correlated modes of thought, such as those that have been mentioned. In considering their relations to government it may become a responsibility of scientists to join those concerned with study of these other aspects of thought if the ultimate human meaning of scientific truth is to be made clear.

The significance of science as an essential feature in the life of the nation will be kept in balance by the people according as experience and education establish standards of value in which science and its truths take their place along with other critical human necessities. The scientist will not lose sight of the idea that his subject is only one of several requisite groups of things. And while it is necessary to remember that he will be held responsible if he fails to set forth the worth of his discoveries, it is also important to realize that science will be held responsible if over-emphasis is given to isolated groups of facts without reference to their real human signfiicance. It is the responsibility of science to state the truth cautiously, and with care that harm be not done. The manner in which a thing is presented sometimes goes far to nullify the value of what may have great intrinsic importance.

Science should help to develop a clear appreciation of the needs of government, and so to organize and interpret its findings as to aid in solution of all possible problems. This means effort to learn what the application needs are, in order to be aware of the places to which new materials should go for the highest types of use.

The scientist should not necessarily expect to administer the results of his own work, and yet the relation to administration is extremely important. He can not avoid considering the broader implications of his contribution, any more than the student of human questions can avoid knowing something of the meaning of scientific problems if the results of science are to be fitted into the economic or governmental plan.

With these known factors concerning the value and opportunity of science appreciated by an intelligent, educated people, thinking continuously, constructively and unselfishly upon needs of the government, a great contribution would be made in guiding the nation along a safe course.

THE DUAL PRINCIPLES OF EVOLUTION[1]

By Dr. HENRY FAIRFIELD OSBORN

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I APPRECIATE the opportunity, afforded by Director Redfield's invitation, of summarizing fifty-five years of reflection and observation in the battlefield of evolution, as well as of personal experiences with Hux-

[1] Paper presented to the Seminar of the Biological Laboratories, Harvard University, November 2, 1934. This is the twelfth contribution by the author on the Origin of Species and the principles of biomechanical adaptation as demonstrated in paleontology. The eleventh contribution on this subject was the Eleventh Sedgwick Memorial Lecture: "Aristogenesis, the Creative Principle in the Origin of Species," *Amer. Naturalist,* lxviii: 716, 193–235.

ley, Darwin, Haeckel, Weldon, Bateson, Poulton, Cope, Dall, Packard, MacBride, Lloyd Morgan, T. H. Morgan and other evolutionists.

Like a moth to the flame we are attracted to the eternal problem of the causes of adaptation. The nearer we get to adaptation the more our intellectual wings are singed until we end in agnosticism or despair. In the recent language of Bohr:

> On this view, the existence of life must be considered as an elementary fact that can not be explained, but must be taken as a starting point in biology, in a similar way as the quantum of action, which appears as an irrational element from the point of view of classical mechanical physics and, taken together with the existence of the elementary particles, forms the foundation of atomic physics.

A very sharp distinction must be drawn between the *modes of adaptation* which paleontology reveals with unique fullness and the *causes of adaptation* which paleontology still leaves an inexplicable blank.

First, let us briefly review the history of speculation as to the causes of adaptation.

If, in Bohr's opinion, life can not be explained, the adaptive evolution of the geneplasm is infinitely more inexplicable. Each of the four classic explanations originating in the brilliant intellects of the Greeks, modified, elaborated and experimented upon, down to the present time, appears naive and futile in the light of modern discoveries. Biologists, like religionists, congregate in schools and unconsciously adopt creeds. Volumes have been written and old friendships severed in the discussion of the relative merits of these four classic explanations.

Second, the entelechist steps in with his *petitio principi* of an internal perfecting principle. Paleontology does not support entelechy in the sense of Driesch. Paleontology does reveal an internally reacting adaptive principle in the sense of Aristotle. Paleontology also reveals a reacting creative principle unknown to Darwin and all his predecessors. The evidence for this duality may be epitomized for this afternoon's seminar.

Third, geneticists and experimentalists, while contributing brilliantly to the structural and functional bases of heredity, are not contributing at all to our knowledge either of the modes or of the causes of geneplasmic adaptation. Adaptation is secular rather than temporal, a matter of more or less rapid motion of an almost infinite number of coordinated organs. The motion of a bombarded gene or of a tortured and hybridized *Drosophila* is a temporal, ephemeral and lawless motion. The geneticists and experimentalists are unable to observe the secular or age-long motion or activation of the biomechanical geneplasm which we are now able to measure very accurately in mammalian phyla which extend through long periods of geologic time.

Fourth, anatomists, zoologists and paleontologists who are making marvelous discoveries in the *modes* of evolution rarely concern themselves either with the causes of adaptation or with the principles of heredity. *It is only by the combined observation of the principles of heredity and of the modes and principles of biomechanical evolution that the causes of adaptation may be intelligently explored.*

Variation: In these Mendelian days it is recognized that a very large part of the Variation studied with such precision by Weldon and others is due to tetraplastic modifications of the soma; it is only the geneplasmic Variations in Weismann's sense which count, as in fact was clearly recognized by Darwin. The old dogma that evolution is by Heredity, Variation and Selection, which still lingers in many text-books, means nothing now; it is an outworn biological creed.

Entelechy: The first of the four classic explanations is that of an internal perfecting principle. The biomechanical evolution of the Proboscidea proves that every single organ and every part of an organ progresses in adaptive direction and in accelerated motion, not according to an internal perfecting principle, but according to the amount of service which, under new conditions of life, it renders to the organism as a whole. For example, the specialization of the pair of inferior incisive tusks takes no less than thirteen different directions to serve the organism in thirteen kinds of plant feeding. Passing by entelechy as contrary to paleontology let us review the other chief lines of speculation and hypothesis since 1859.

Darwinism: Selection, the second of the four classic explanations, is not a bio-energetic process; it is outside of the energetic field; it is judge, jury and executioner in organs and organisms of every degree of fitness; it awards premiums to all changes of proportion which favor the struggle for existence; in these indirect senses only is it originative of species. It can now be proved from the evolution of the Proboscidea that many of the modes of motion and activation are independent of Selection. Selection, while not in the energetic cycle, is constantly standardizing the geneplasm and testing its adaptive or inadaptive reactions to habit and the organic and inorganic environment.

Lamarckism: There is, third, the classic bio-energetic explanation of the geneplasmic inheritance of the somaplasmic response to (a) the energy of physical environment, (b) the energy of living environment, (c) the energy of habit or function, (d) the energy of heredity. This fourfold somatic response is summed up in the word *tetraplasy*, signifying that every organism and its variants are a resultant of

adaptive actions, reactions and interactions of four complexes of energy. Lamarck's explanation of the immediate geneplasmic inheritance of somatic adaptations to new habits is thoroughly disproved both by observers of heredity and observers of biomechanical evolution in paleontology. Apparent cases of Lamarckian inheritance are best accounted for by the Baldwin-Morgan-Osborn principle of coincident-variation (Lloyd Morgan) or organic-selection (Baldwin).

Buffonism: There is slowly accumulating evidence for Buffon's explanation of real geneplasmic modification under new physico-chemical stimuli; it is interesting to recall that French evolutionists of the Cuvier period appealed to America for proofs of the alleged principle that old-world animals and plants were being modified or *dénaturées* by new-world environment. This "direct-action-of-environment" principle is demonstrable experimentally, but still more strongly by field zoologists in the origin of new sub-species and, ultimately, of new species. It is self-evident that the chemical constitution of the geneplasm may mutate or evolve in a new chemical environment. Also, we observe in paleontology that a new secular environment stimulates activation of the geneplasm both in the modification of existing structures and in the origin of new aristogenic characters. Paleontology reveals new truths and principles drawn from the observation of the secular influence of the energy of habit or function upon the energy of heredity.

Weismannism: Conservation and stability of type seem to be the chief functions of the energy of heredity; in biomechanisms the slightest deviation from the standard biochemical type is apt to be punished by death and finally by extinction. How, then, is progressive heredity possible? Through the Selection of Variations or Mutations, however small, said Darwin. Through the selection of genetic mutations, say Morgan and Conklin.[2] Paleontology reveals the fact that beside the function of stability, the geneplasm possesses the potentiality of modifying all its existing biomechanisms and of originating new biomechanisms. How are these modifications and aristogenes brought about?

Zoologic Modes of Adaptation: In brief, ten chief modes of biomechanical modification of organs have been observed by zoologists, anatomists and embryologists from the times of Aristotle to those of Goethe and Dohrn. These are: (1) progression or development, (2) acceleration or hurrying forward, (3) retrogression or degeneration, (4) retardation or slowing down, (5) compensation or balance, (6) economy the adjustment to service, (7) alloiometry or change of proportion, (8) coadaptation, (9) coordination and correlation, (10) auto-adaptation, including change of function or neo-adaptation. All these ten modes of adaptation, first observed by anatomists and zoologists, are brilliantly illustrated in the biomechanical evolution of the Proboscidea over their sixty million year period.

It is these ten modes of the biomechanical adaptation of separate organs to which the four classic explanations of Darwin, of Lamarck, of Buffon, of Weismann are still being applied. You may verify this statement by a reperusal of the evolutionary speculations of Empedocles and Aristotle to Darwin, Weismann and Driesch, also by an examination of most of the modern text-books of zoology which take no account of the seven new modes of adaptation discovered in paleontology.

Secular Heredity: Geologic time reveals to the paleontologist the seventeen or more modes of adaptive motion in the geneplasm, which are hidden to the geneticist and experimentalist. The two charts of the Titanothere thirty million year phylogeny and of the Proboscidea sixty million year phylogeny are not mere representations of fossil Titanotheres or fossil elephants but are the visible or phenotypic expressions of geneplasmic adaptation. Secular heredity is an altogether different phenomenon from laboratory heredity.

Paleontologic Modes: Thirty-four years of intensive research on the Titanotheres and Proboscideans has not only confirmed and amplified to an incredible extent the above ten modes of zoologic adaptation, but has added seven modes of paleontologic adaptation which can be observed only in closely connected lines of ascent through longer or shorter periods of geologic time—in brief, through phylogeny as distinct from ontogeny. These recently discovered and confirmed modes of adaptation are:

(1) *Phylo-mutation or W. mutation* of Waagen, 1869, the slow origin and rise of a new character or "aristogene" over a long period of geologic time. (2) *"Mutations-richtung"* of Neumayr, the genetic trend of W. mutations, or "aristogenes" to go on increasing in an orthogenetic direction, sometimes termed "momentum." (3) *Genetic-continuity* or unbroken origin as contrasted with discontinuous or mutational origin of new adaptations or aristogenes. (4) *Genetic potentiality* or the independent origin of similar characters at different periods of geologic time from similar ancestral stocks. (5) *Genetic predetermination* closely connected with potentiality, as in the origin of horn rudiments in Titanotheres of similar stock in successive periods of geologic time. (6) *Aristogenesis* (Osborn, 1931) (*-rectigradations,* Osborn, 1889), the creative mode of origin of new adap-

[2] E. G. Conklin, *Proc. Amer. Phil. Soc.*, lxxiv: 1, 155, 1934.

tive biomechanisms. (7) *Reciprocal bio-mechanical reaction.* Mechanical reactions of the inferior grinding teeth of the Proboscidea are the reversed mechanical reactions in the superior grinding teeth. For example, all *convex* curves in the superior enamel foldings are opposed to *concave* curves in the inferior enamel foldings and *vice versa.*

Aristogenesis: (*a*) The seven modes of geneplasmic origin newly discovered through the intensive comparative study of fossils of three widely distinct mammalian stocks, assembled from all parts of the world, reveal in the geneplasm the *dual creative principle* unknown in the time of Darwin and unexplainable by any of the four classic explanations of the causes of adaptive modification. (*b*) These new characters are called "aristogenes" because they arise directly from the geneplasm; unlike modifications they are antecedent to function, use or habit; they add something entirely new to the organism; they demonstrate genetic potentiality; they arise through genetic predetermination; they slowly and continuously progress in an adaptive direction; they harmonize with the seven modes of biomechanical adaptation discovered in paleontology as well as with the ten modes of biomechanical adaptation observed in zoology. (*c*) On coming of age, namely, into coordinated use and function with the entire organism, aristogenes become subject to development or degeneration according to their service to the organism. (*d*) An aristogene is readily distinguishable from a D. mutation of DeVries, because it is wholly the product of law rather than the product of chance.

Aristogenesis, the creative origin of new characters, is a geneplasmic principle altogether new to biology. It is quite distinct from morphogenesis, the modifications of proportion and form, of intensity and degree, of plus or minus variation, of development or degeneration, of existing characters.

Modifications: The causes of modifications (a term proposed by Lloyd Morgan) are partly explainable at the present time. The causes of aristogenes are largely beyond us. Morphogenesis is a universal phenomenon; aristogenesis is relatively rare and infrequent. The differences between these dual principles, the creative and the modifying, are clearly illustrated in the comparison between the Titanothere and Proboscidean phylogeny. For example, the only aristogenes observed in the Titanotheres are the paired horns. These animals had a relatively brief geologic existence. In the Proboscideans the innumerable aristogenes in the grinding teeth, combined with adaptive alloiometrons or changes of proportion and function in the tusks, prolonged the individual existence of the elephant to a century and the racial existence of the Proboscidea to sixty million years.

Conclusions: While zoology and paleontology, during the past twenty-two centuries, have almost completely revealed the *modes of adaptation,* we have waited for relatively recent discoveries in biophysics, biochemistry and physiology for vistas into the bioenergetic causes of adaptation. We are hopeful that the invariable sequence of the origins of new adaptive aristogenes and of new adaptive alloiometrons may in time enable us to establish antecedent secular causes and subsequent secular origins of adaptations. This is the only outlook as to causation which the evolution of the Proboscidea reveals at present.

Hormones, Chalones: It is a very striking generalization that three of the ten principles of zoological adaptation may theoretically, in part or in whole, be connected with hormones as the accelerators of motion, or with chalones the retarders of motion, or with these endocrines as coordinators of motion. I have applied to Spemann for a hypothesis of paleontologic "organizers."

Osborn, Keith and others have applied hormone principles to the biomechanical differentiations of the human races; it well may be one hormone which makes a child or a race *brachysomatic* or broad in all its dimensions—skull, skeleton, limbs, hands and feet. It may be another hormone which makes every part of the skeleton *dolichosomatic*—narrow skull, tall narrow skeleton, long slender fingers and toes. I have examples of these two extremes in two of my granddaughters.

But such diffused broadening and shortening or narrowing and lengthening hormones can not explain the excessively localized shortened face and lengthened cranium of the Titanothere or the shortened cranium and lengthened face of the horse. In brief, incredibly localized metamorphoses lengthening or shortening, broadening or heightening, developing or degenerating, accelerating or retarding, are observed in closely contiguous organs or parts of organs. It is in this acceleration of one minute part of a complex grinding tooth and retardation of an immediately contagious part that all hormone, chalone and endocrine hypotheses fail. Accordingly disharmonic biomechanical adaptation is far more frequent than harmonic. Not only every single organ but every single constituent part of every single organ in the Proboscideans reacts to its own particular biomechanical task. Moreover, every single anatomical unit adaptively reacts to its own particular environmental conditions and problems. Equally incomprehensible in the adaptations of the Proboscidea are the causes of the perfected compensation and economy, even in parts which are very remote from each other.

None the less the basic hormone idea of chemical messengers which accelerate or retard or organize the

motions of the individual parts is the only outlook we have into the possible causes of the modification principle of geneplasmic adaptation. We have not even a glimmer of a hypothesis as to the causes of the dual creative or aristogenetic principle in evolution.

Fortified with a complete knowledge of what may be actually observed and measured in anatomy and physiology, zoology and paleontology, the most hopeful line of escape from Bohr's agnostic position seems to be in biophysics, biochemistry and bioenergetics. The most hopeful outlook for the future of the Harvard Biological Laboratories, as I understand the wide scope of your personnel and the equally wide reach of your apparatus, is a collective creed that life and adaptation in all their aspects, past and present, present a single rather than a multiple problem which must be attacked by the combined synthetic research of all the adaptive phenomena of past as well as present time.

THE MEASUREMENT OF PERSONALITY

By Dr. LEWIS M. TERMAN

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THE measurement of personality is bound up with the question of psychological measurement in general. Hardly anything has so affected the aspect of experimental psychology during the last quarter century as the introduction and development of quantitative methods. Their influence on the whole has been good. The non-quantitative categories of descriptive psychology were frequently too ill-defined to be very meaningful or to offer fruitful points of departure for experimental work. More and more the descriptive approach is being abandoned in favor of procedures which are quantitative and often elaborately statistical.

It is well to remind ourselves, however, that the application of quantitative methods does not guarantee new psychological insights. Moreover, measurement enthusiasts too often lose sight of the inherent difficulties, even dangers, involved in the reduction of psychological data by the mathematical tools that are so indispensable in the physical sciences. Perhaps no saying of Thorndike's has been so often quoted as his statement that "whatever exists exists in some amount and can be measured." These words have been taken up by his followers and turned into a veritable battlecry in their assaults upon every psychological stronghold, including even those mysterious characteristics that go to make up what is known as "personality."

Is it really possible to measure personality in the strict sense of the word "measure," as the physicist, for example, is accustomed to use the term? To measure in this sense implies that we have a measuring scale with a zero point and with equal units throughout; a scale on which the score 20 is exactly twice the score 10, or the score 100 exactly five times the score 20. Every one acquainted with the literature of the subject knows that no such scale is available for the measurement of personality. In fact, no one so far seems even to have essayed the task of deriving a personality test that would "measure" in this strict sense of the word. Is any such goal attainable, either now or ever?

Let us turn to the field of intelligence, where quantitative methods have been so much more extensively cultivated than in the study of personality, and note what progress has been made since the early adventures of Galton in what he called "psychometrics." Binet, after many years of explorative work with mental tests, gave us a "measuring scale of intelligence." However, Binet was careful to point out that his scale does not, strictly speaking, measure intelligence, since it has neither a zero point nor equality of units. He tells us that instead of measuring intelligence in any absolute sense, his tests merely bring to light the hierarchy of developing intelligence. This is the sense in which the word measurement has been used by the majority of Binet's followers; it is the connotation which the present writer had in mind in entitling one of his books "The Measurement of Intelligence." Thorndike, on the other hand, in a more recent book bearing the same title, attempts to demonstrate that it is possible to measure intelligence in the same sense as a physicist measures distance or mass or time. His CAVD intelligence scale has what purports to be a zero point and units which are equal. The scores of the scale range from 0 to 43. Zero intelligence is just less that which leads one to spit out a substance that has a very bitter taste or to retain in the mouth a substance that tastes sweet. We will pass by the seeming arbitrariness of this standard, as well as the questionable procedure by which it was derived, and consider the results of applying the CAVD scale in the measurement of absolute intellectual differences. Score 43 represents approximately the intelligence of a college professor or the exceptionally gifted student. By the verdict of the CAVD scale the average child of six years has almost exactly three fourths this amount of intelligence, and the half-way point between zero and moderate genius (score 20) is repre-

sented by a mental age level of about three years, which is just at the borderline between high-grade idiocy and low-grade imbecility of an adult defective! It hardly seems necessary to argue about the merits of a measuring scale that leads to results so patently absurd.

It seems to me that the absurdities derive not so much from the particular methods which Thorndike has used in making his scale as in the very undertaking itself. Before attempting to answer the question whether A has twice or three times or four times as much intelligence as B, it might be well to consider whether such a question is capable of being answered or even whether it makes psychological sense. We are so accustomed to use numbers to express the results of our investigations that we end by taking them too literally. It is very well that we should count the errors and the minutes in a maze performance, the number of books written by literary geniuses in each life decade, the number of items correctly answered in an intelligence test, or the number of lines of poetry memorized. Rough quantification of our findings is necessary and will be helpful so long as we remember that it is rough. The truth is we do not yet have and may possibly never have psychological measuring units which are straightforward and unambiguous. There is yet no rigid technique for comparison of gains in a practise experiment, losses in a forgetting experiment, the amount of fatigue in a continuous work experiment or the percentage loss of intelligence in senile decay.

If this is true in the older fields of psychological experimentation it is even more true in the "measurement" of personality. Surely it is no more than a figure of speech to say that A is twice as introverted as B, three times as submissive as C, half as fair-minded as D, 25 per cent. less masculine-minded than E, three times as witty as F and has twice as much inferiority feeling as G. Indeed, personality testing is in about the stage that intelligence testing was passing through in the nineties of the last century. We are not measuring personality, but exploring with improvised tests, too often haphazardly, to see how people respond. We are still groping, as Binet groped for nearly fifteen years before he was in position to put together an intelligence scale. And Binet's experience has much to teach us. He did not begin with a rigid concept of intelligence, but tried out a succession of tentative hypotheses. His favorite method was to apply his tests to contrasting groups—children and adults, normals and institutional defectives, "bright" and "dull" school children. Patiently he studied the responses of such groups to a great variety of tests—rote memory, logical memory, word knowledge, simple reaction, choice reaction, continuous association, finding likenesses and differences, detecting absurdities, defining abstract terms, copying designs, handwriting, physical measurements, etc. By noting how his contrasting groups responded to such tests he was able at last to eliminate those of least value and to find others better than he had previously hit upon.

This is the kind of work most profitable in the present status of personality testing. Many examples could be given of its effective use. When Woodworth set about devising a test of psychopathic tendency he ransacked the leading text-books in abnormal psychology and embodied in questions, for the testee to answer, those abnormal symptoms most commonly agreed upon by psychiatric authorities. Responses to these questions were then secured from such contrasting groups as unselected normals and patients known to be suffering from mild mental disorder. Much earlier the Kent-Rosanoff standardization of the free association test upon 1,000 unselected adults had been followed by studies of such contrasting groups as college students and psychopathics, young and old subjects, men and women, etc. Miles (Catharine) and Terman have used the method extensively in connection with a series of studies (not yet published) of mental masculinity-femininity. In this case some thousands of test items were assembled which, on the basis of the existing literature on sex differences, looked as though they might differentiate between the sexes. They were tried out on male and female groups and the non-discriminating items were eliminated. The remaining items, some 950 in all, were arranged in two "forms" of an M-F test. It is the method which E. K. Strong has followed in the development of his Occupational Interest Test, and with the result that he can now score his test so as to differentiate between all the leading types of occupational interest, between stages of interest maturity and between masculinity and femininity of interests. Numerous other examples of the use of this method could be given. It is the method *par excellence* of getting together, not a finished personality test, but a first approximation to such a test. By a series of approximations, each based upon tests of contrasting groups, with analysis of responses by the groups to every item, the instrument is gradually brought to the second, but by no means its final, stage.

The next step is to make more definite the meaning of scores yielded by the test. This requires a procedure which is the reverse of that just described. Whereas, to begin with, roughly contrasting groups were used as a means of improving the test, the test itself is now used to pick more purely contrasting groups for further psychological study. For example, once a test of introversion has been brought to this

stage, intensive study should be made of groups of subjects who have scored at the extremes on the test. Herrington has in fact investigated the physical correlates of introversion-extroversion by a comparative study of contrasting groups selected on the basis of scores on three tests of this trait. Oliver, using a similar method, investigated a number of the psychological correlates of the same trait. Always, when a test has been put through the first stages of validation, it should be administered to a large variety of populations, especially to contrasting groups, in order to make the scores yielded by the test more meaningful. Usually a huge amount of this kind of comparative work is necessary before the use of the test in clinical practise is warranted.

This intensive study should be both statistical and clinical. The clinical approach has been particularly neglected in this connection. Exhaustive analyses should be made of the behavior characteristics of individuals who test as extremely self-sufficient, fair-minded, introverted or extroverted, dominant or submissive, masculine or feminine, mature or immature in their interests, etc. Moreover, enough subjects at each extreme should be thus clinically studied to make generalizations possible, for case histories taken singly are notoriously futile. We want to know what is *generally* true of extreme cases, and not only this, but also what kinds of exceptions there are to the general rule. These clinical studies should sample the entire population, from the mentally defective to outstanding genius of every kind. Clinical biography should be cultivated, for we have here an almost untouched field, one that promises more for the understanding of the adult personality than any amount of alleged "measurement" by the method of tests, however valuable the latter may in time become. Laswell's studies of agitators and reformers are suggestive in this connection and should be extended and refined.

The clinical approach is absolutely necessary for the interpretation of personality as a whole, for a true picture of a personality can not be pieced together from any number of test scores. The total is an organismic, not an additive, total. Personality traits are not merely intercorrelated, but are functionally interactive in infinitely complex ways now little understood. This fact is familiar to us in the concept of compensation. The presence of inferiority feelings may give rise either to a chronic attitude of self-depreciation or, by over-compensation, to an attitude of boastfulness. Physical cowardice may give us either the typical coward or, by over-compensation, the foolhardy daredevil. The boy of naturally effeminate tastes and attitudes does not always develop into a sissy; he may cultivate the ways of the cave man and flaunt his masculinity. If one is naturally prone to form emotional prejudices, *and knows it*, one may succeed in becoming a Darwin of fairmindedness. One who is excessively introverted does not ordinarily become a good salesman or an effective leader, but by taking thought he may become either. It is one of the great weaknesses of personality tests that they can not discriminate between behavior attitudes that are the expression of the subject's natural personality characteristics and those that have been acquired by compensation or self-discipline. Moreover, the behavioral significance of a given amount of a particular trait is never unequivocal; it is always dependent upon the other trait complexes in which it is imbedded.

There appears to be a wide-spread opinion among psychologists that the methods of factor analysis, especially as developed by Thurstone, will prove a powerful tool in untangling the skeins that make the warp and the woof of human personality. That they can be very useful in analyzing the content of current personality tests has indeed been sufficiently demonstrated. They have shown that a large collection of personality tests which yield scores on a vast array of alleged personality "traits" may possess altogether not more than four or five distinguishable components. It is well to know this, but it is another thing to conclude that the total personality can be accounted for so simply. There must be, certainly are, many factors of personality that have not been and can never be embodied in our tests. These unknowns are always entering to upset our interpretations of test scores and to limit their usefulness when we apply them in our attempts at personality diagnosis and adjustment. There are no statistical short cuts to the understanding of human nature.

At present personality tests of children give a very slender basis for prognosis. In this they resemble the intelligence tests of a quarter century ago. At that time no one could predict from the best intelligence tests what the later course of intellectual development was likely to be. Since then follow-up studies and retests have made it possible, within reasonable limits, to predict from the intelligence score of an eight-year-old child what the subject's adult level of intelligence will be and what educational accomplishments can be expected. No one knows whether there is any such constancy in the field of personality. It may be that compensations and other cross currents are capable of altering the entire landscape of one's personality in a few years. No one knows how serious for later life a given personality fault of childhood may be. The only way to find out is to make minute studies of the personality characteristics of large groups of young children and follow their later development into adult life.

Until longitudinal studies of this kind have been made, the school counselor and mental hygiene "expert" will be working in the dark. At present they can only guess at the prognostic significance of the personality traits they discover, whether by the use of tests or by means of clinical observations. The psychologist stands aghast at the self-assurance with which the professional school counselors in America diagnose the personality faults of little children and at the boldness with which they undertake the delicate task of adjustment. That some counselors do much good, by the mere application of common sense, will of course be admitted; that others do real harm is hardly less certain. The student of genius who is familiar with the motivating influences that have their origin in quirks of childhood personality shudders to think what the result would have been if school counselors had had a chance to "adjust" the personalities of some of the budding geniuses of history. One can imagine them, freed of all their peculiarities and complexes, adjusting to the world as it was and becoming undistinguishable from the human herd.

Some day, it is to be hoped, the psychologist will know how and when to adjust personalities; at present he knows very little about it and the professional school counselor knows even less.

OBITUARY

SIR HORACE LAMB[1]

IN the death of Sir Horace Lamb, which occurred on December 3, at the age of 85, mathematical science loses one of its brightest ornaments and Cambridge society one of its most venerable figures. During his long life he systematized several branches of applied mathematics, in addition to making to them individual contributions of the highest importance. Hydrodynamics was the most vigorous offspring of his fertile brain, but tidal theory and seismology owe not a little to him, as also does aeronautics, to which his years of retirement were largely devoted. The primary aim of science in Lamb's view was to explore the facts of Nature, to ascertain their mutual relations, and to arrange them so far as possible in a consistent and intelligible whole. The material effects came later, if at all, and often by a very indirect path. The mathematician's task, to his mind, had an esthetic character. He took delight in the comparison of a well-ordered piece of algebraic analysis with a musical composition, and bemoaned the passing of the scientific memoir, which in the hands of a Lagrange or a Poisson had the completeness and austerity of a great work of art.

Lamb was born at Stockport on November 27, 1849. From Stockport Grammar School he passed on to Owens College, Manchester. The college was already gathering to itself a brilliant body of teachers. The professor of mathematics, Barker, had the singular habit of teaching quaternions before Cartesian geometry, but this was perhaps no disadvantage with his abler pupils, such as Lamb and J. J. Thomson. Like Thomson, his junior by seven years, Lamb went up to Trinity College, Cambridge, and there became second Wrangler and second Smith's prizeman. He was elected a fellow of his college and quickly began those hydrodynamical investigations on which his fame so securely rests.

This particular line of research fitted in well with the general revision of the special sciences then being conducted under the stimulus of Thomson and Tait's "Natural Philosophy." But in 1875, on his marriage to Miss Elizabeth Foot, of Dublin, Lamb accepted an invitation to become professor of mathematics at Adelaide University. He took advantage of the change to set his ideas in order, and in 1878 his first book appeared under the title, "A Treatise on the Mathematical Theory of the Motion of Fluids." His treatment of vortex and cyclic motion, with their electromagnetic analogues, the discontinuous jets of Helmholtz and Kirchhoff, the motion of perforated solids through a liquid, and the effects of viscosity was bold and original. The skill with which he handled the complicated mathematics, his lucidity, and his powers of systematization won for him an immediate and complete success. From 1881 to 1884 he published a brilliant series of memoirs dealing with the application of harmonic analysis to vibrational problems.

Obviously his recall to England could not be long delayed. In 1884 he was elected a fellow of the Royal Society, and in the following year he returned to Manchester to succeed his old teacher as professor of mathematics. In 1889–90 he published a number of valuable papers on the elastic deformation of plates and shells. To his administrative abilities no less than to his teaching the young university—it had received its charter in 1880—owed more than can be expressed. He was president of the Manchester Literary and Philosophical Society, one of the most important of the provincial academies. He retired from his chair in 1920, though still displaying the vigor of many a man 20 years his junior, and went to live at Cambridge.

Lamb's teaching years were marked by a succession of books, of which his "Hydrodynamics," published in 1895, has become the standard treatise on the sub-

[1] Abridged from an article in the London *Times* [December 4].

ject. The sixth revision, in 1933, although the work of a man of 83 and not wholly brought into line with the latest ideas, shows no signs of being superseded. His "Elementary Course of Infinitesimal Calculus" went into a third edition in 1919, which was significant of the new and more logical treatment of the exponential function on the basis of its fundamental property. His "Dynamical Theory of Sound" appeared in 1910, his "Statics" in 1912, and his "Dynamics" in 1914. The series was completed by his "Higher Mechanics" in 1920.

To Lamb, who so ardently taught that science was its own reward, there fell more than the usual share of honors. In the case of the Royal Society, honors were accompanied by duties, for he served on its council for three periods of two years and was twice vice-president. He was awarded the society's Royal Medal in 1902 and its highest honor, the Copley Medal, in 1924. Seven universities honored him with their doctorates. He was a foreign member of the Reale Accademia dei Lincei and Trinity College, Cambridge, made him an honorary fellow. He was president of the London Mathematical Society from 1902 to 1904, and De Morgan medallist in 1911. As a sectional president of the British Association in 1904, he devoted his address ostensibly to the place of Stokes in mathematical physics, but really covered the whole evolution of the science; and in presiding over the whole association at Southampton in 1925 he dealt specifically with the progress of geophysics. His Rouse Ball lecture at Cambridge in 1924 gave him another opportunity to dilate refreshingly on the evolution and character of his science. He was knighted in 1931.

RECENT DEATHS

DR. ROLAND BURRAGE DIXON, professor of anthropology at Harvard University since 1916, died on December 20. He was fifty-nine years old.

DR. MILO SMITH KETCHUM, dean emeritus of the College of Engineering at the University of Illinois and director of the Engineering Experimental Station, died on December 19, in his sixty-third year.

SCIENTIFIC EVENTS

SYMPOSIA ON DISTILLATION AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

THE first of a series of symposia under the auspices of the division of industrial and engineering chemistry of the American Chemical Society will be held at the Massachusetts Institute of Technology on December 28 and 29, for discussion of the chemical engineering features of distillation.

The meeting will bring to Cambridge the leading authorities from all parts of the country to discuss the latest developments in this field.

Distillation is an operation that is becoming of increasing importance in a wide variety of industries for separating liquids into fractions of desired physical and chemical properties. The commercial production of solvents, gasoline, kerosene, fuel oils, alcohol, glycerine, compressed oxygen and many other valuable materials in daily use has been made possible by the effective design of distillation apparatus.

The men responsible for these developments are scattered throughout the country in industry and in academic pursuits, and the forthcoming meeting will enable them to exchange information and ideas and advance their general knowledge by informal round table discussion. Some of the papers to be presented will deal with the general theory of distillation and rectification design, others will describe its application to industry and its importance to the practical operating man, while the remainder will give detailed experimental data on the separation of complicated mixtures containing three components. The authors have been selected from the petroleum industry, the chemical industry, the manufacturers of distillation equipment and the teaching profession. Brooklyn Polytechnic Institute, Columbia University, Cornell University, Massachusetts Institute of Technology, University of Illinois, University of Michigan and Yale University will all be represented on the program by members of their faculties.

The meetings of the symposium will be held in the Eastman Research Laboratories of Physics and Chemistry at the Massachusetts Institute of Technology, under the chairmanship of Professor F. W. Adams. The first session on Friday afternoon, December 28, will be devoted to a technical session followed by a round table discussion of design methods. The balance of the technical program will be presented on Saturday morning, December 29, starting at 9 A. M. An informal dinner meeting has been arranged for Friday evening when Professor Warren K. Lewis will address the gathering. A group luncheon on Saturday will complete the social side of the program.

A large attendance is expected at the meeting, not only from New England, but from all over the country. By having the symposium during the Christmas holiday period it will be possible for students as well as others interested in distillation to meet the leaders in this field.

DEDICATION OF THE WASHINGTON, NORTH CAROLINA, FIELD MUSEUM

THE new building of the Washington Field Museum, Washington, North Carolina, as reported in

The Museum News, was formally opened to the public by the mayor of the city on November 12.

The new building is a log structure with a two-story central portion and three one-story wings. It includes exhibition space, meeting hall, work rooms and storage space. The whole of the lower portion is without windows, each case or section being equipped with shaded electric light so that the exhibits can be plainly seen and the labels read. More than two thousand specimens have been relisted and arranged in new cabinets in the new quarters. The building is on Jacks Creek near the foot of Second Street, in the new City Park which has been established as a CWA project. A portion of the funds for the building was raised by a campaign this spring in which donors were given recognition in a unique manner. Each log and square of the roof was "sold" at a specified price and the names of the donors placed on a model of the building which was displayed in a prominent store window and then removed to the museum building.

The museum is the creation of a group of boys, who began work in 1923 in a tent, and moved successively to a home, an old shop and then to the second floor of the City Hall. Its collections include rocks and minerals, fossils, botanical material, insects, fishes, amphibians, reptiles, birds and bird eggs and mammals; also guns, coins and historical objects.

Speakers at the opening ceremonies in the museum and at a dinner on the same evening at the Parish Hall included H. H. Brimley, director of the North Carolina State Museum; L. C. Warren, member of the Congress; B. B. Brandt, of Durham; E. S. Johnson and J. G. Bragaw, of Washington; J. F. Oertel, of Vienna, Va.; George W. Ross, president of the museum, and Roderick L. Cotten, director. The museum is open to the public from 7:30 to 10:30 in the evenings and on Sunday afternoons.

THE TWENTY-FIFTH ANNIVERSARY OF THE NEW YORK NEUROLOGICAL INSTITUTE

THE twenty-fifth anniversary of the founding of the Neurological Institute of New York, now part of the Columbia-Presbyterian Medical Center, was celebrated on December 20 with appropriate ceremonies.

Telegrams of congratulation commending the achievements of the institute and its pioneer work in the research and treatment of the diseases of the brain and the nervous system were received from President Roosevelt, Governor Lehman and other leaders in American life.

The principal speaker was Dr. Joseph Collins, the sole survivor of the three original founders of the institute. A silver tray was presented to him on behalf of the medical staff of the institute by Dr. Edwin G. Zabriskie, chairman of the medical board, who introduced Dr. Collins.

Other speakers were Dr. Bernard Sachs, retiring president of the New York Academy of Medicine; Dr. Willard C. Rappleye, dean of the College of Physicians and Surgeons, Columbia University, and Dean Sage, president of Presbyterian Hospital. The speakers were introduced in the order given by Dr. Frederick Tilney, director of research of the institute; Dr. Charles A. Eisberg and Dr. Walter Timme.

President Roosevelt's telegram, addressed to Miss Mabel Choate, acting president of the institute, read:

> Press of work prevents me from personally participating in the celebration of the twenty-fifth anniversary of the founding of the Neurological Institute. I am glad, however, to take this opportunity to extend congratulations to you and your associates for the high professional ethics maintained by the institute and the splendid work you are doing.

Governor Lehman's telegram read in part as follows:

> Since its organization I have been acquainted with the work that the institute has carried on and know from personal knowledge of its fine achievements and constructive service to the community. As governor of the state I have been particularly interested in the work of your institute because of its close association with the New York State Psychiatric Institute and Hospital and because of the splendid service rendered by Dr. Tilney and so many of your other physicians to the state in the administration of the State Training School for Boys at Warwick. This is merely another evidence of the readiness to serve and to lead which the Neurological Institute has always shown. May I add my personal and my official congratulations and express the hope that the work of the institute will continue and grow through the years.

AWARD OF THE WILLIAM H. NICHOLS MEDAL

THE William H. Nichols Medal of the New York Section of the American Chemical Society for 1935 has been awarded to Father Julius A. Nieuwland, professor of organic chemistry in the University of Notre Dame.

The award, one of the highest honors bestowed by chemical science in this country, goes to Father Nieuwland "for basic work on syntheses from unsaturated hydrocarbons."

Working in a field beset with dangers, Father Nieuwland successfully carried out investigations in the chemistry of acetylene, his discoveries being utilized in subsequent research in the laboratories of E. I. du Pont de Nemours & Company, Wilmington, Del., which led to the development of the synthetic rubber called "Du Prene."

According to the announcement by Dr. J. M. Weiss, chairman of the jury of award:

> Father Nieuwland was engaged for many years in investigations of reactions of acetylene hydrocarbons and derivatives, a field which most investigators had not en

tered because the compounds were unstable and presented serious hazards of explosion.

Persisting, Father Nieuwland learned how to control these reactions and make them safe to handle in general laboratory manipulations. As a result of this work, he was able to produce a number of new and unusual unsaturated hydrocarbons and hydrocarbon derivatives.

The ceremony at which Father Nieuwland will formally receive the medal will be an outstanding event of a week's celebration of the 300th anniversary of the founding of the American chemical industries to be held in New York City in connection with the eighty-ninth meeting of the American Chemical Society beginning on April 22.

The speakers will include the Rev. Father Eugene Burke, of the arts faculty of Notre Dame, whose subject will be "Father Nieuwland—The Man," and Dr. E. R. Bridgwater, who will describe practical applications of his work. Dr. Weiss will present the award and Father Nieuwland will deliver the annual Nichols Medal address.

Father Nieuwland was born in Hansbeke, Belgium, on February 14, 1878. He received the bachelor of arts degree at the University of Notre Dame in 1899. In 1903 he was ordained a priest in the Roman Catholic Church, joining the Congregation of the Holy Cross.

In 1904 he received the Ph.D. degree from the Catholic University, and in 1911 the Sc.D. degree from Notre Dame. He joined the Notre Dame faculty in 1904 as professor of botany, and since 1918 has been professor of organic chemistry. He was dean of the College of Science from 1920 to 1923.

Father Nieuwland is botany librarian and curator of the Botany Herbarium and the E. L. Greene Herbarium at Notre Dame. He is the founder and editor of the *American Midland Naturalist*. In 1904 he published a book entitled "Some Reactions of Acetylene," and in 1917 edited a de luxe edition of Le Conte's unpublished plates.

He is a fellow of the American Association for the Advancement of Science, the British Chemical Society and the Indiana Academy of Science, of which he was vice-president in 1929–30 and president in 1933–34. He is a member of the American Chemical Society, the Chemical Society of London, the Biological Society of Washington, the Deutsche Chemische Gesellschaft and Phi Sigma.

THE EDISON MEDAL AWARD

THE Edison Medal for 1934 has been awarded by the American Institute of Electrical Engineers to Dr. Willis R. Whitney, "for his contributions to electrical science, his pioneer inventions, and his inspiring leadership in research."

The Edison Medal was founded by associates and friends of Thomas A. Edison, and is awarded annually for "meritorious achievement in electrical science, electrical engineering, or the electrical arts" by a committee consisting of twenty-four members of the American Institute of Electrical Engineers.

Dr. Whitney, son of John J. and Agnes (Reynolds) Whitney, was born in Jamestown, New York, on August 22, 1868. He was graduated from the Massachusetts Institute of Technology, with the degree of S.B., in 1890, and in 1896 he received the degree of Ph.D. from Leipzig. He received the honorary degree of Sc.D. from Union University in 1919, and of Ch.D. from the University of Pittsburgh in the same year, of Sc.D. from Syracuse University in 1925, of Sc.D. from the University of Michigan in 1927, of LL.D. from Lehigh University in 1929, and of Sc.D. from the University of Rochester in 1932.

He held the following positions at the Massachusetts Institute of Technology following his graduation: Assistant instructor in general chemistry, 1890–92, analytical chemistry, 1892–94, sanitary chemistry, 1896–98, instructor in theoretical chemistry and proximate analysis, 1898–01, assistant professor of theoretical chemistry, 1901–04, non-resident associate professor of theoretical chemistry, 1904–08, non-resident professor of chemical research, 1908.

Dr. Whitney assumed the directorship of the Research Laboratory of the General Electric Company at Schenectady, New York, in 1900, became vice-president and director of research on July 6, 1928, and vice-president in general charge of research on November 1, 1932.

His most notable achievement has been the creation and development of the Research Laboratory of the General Electric Company at Schenectady. This laboratory, one of the earliest of its kind in this country, the embodiment of the application of science to industry, has gained a world-wide reputation by the quality of its work and the importance of its results. Much purely scientific work of a high order is being done in the laboratory and published in the scientific journals. Among such investigations have been the study of the laws of heat conduction and radiation, the electron emission from hot bodies, ionization, crystal structure, dissociation of gases at high temperatures, transformation of other forms of carbon into graphite, chemical reactions at very low pressures and the vapor pressures of metals.

Among the papers which Dr. Whitney has personally published are: Solubility Determinations, Colloids, Corrosion of Iron, Alloys, Chemistry of Light, Carbon Brushes, Vacua, Phenomena of Catalysis, etc. His translation of LeBlanc's text-book of Electrochemistry is well known.

SCIENTIFIC NOTES AND NEWS

THIS issue of SCIENCE completes the fortieth year and the eightieth volume under the present control and editorship. The journal was established in 1883 by Alexander Graham Bell, who acquired the rights of an earlier weekly publication of the same name, established by Thomas Alva Edison. In 1900 SCIENCE became the official journal of the American Association for the Advancement of Science; in 1925 a contract was signed making the journal under certain conditions the unencumbered property of the association when the present owner and editor relinquishes control.

THE American Association for the Advancement of Science and the Associated Societies will be meeting at Pittsburgh when the present number of SCIENCE is issued. The address of the retiring president, Dr. Henry Norris Russell, will be given on the evening of December 31. Details concerning the program were printed in the issue of SCIENCE for November 30. The special issue of SCIENCE containing the report of the meeting, edited by Dr. Henry B. Ward, permanent secretary of the association, will be published on February 1.

HONORARY membership in the American Society of Mechanical Engineers was awarded at the annual dinner on December 5 to Dr. William F. Durand, professor emeritus of mechanical engineering at Stanford University, and to Dr. David S. Jacobus, head of the engineering department of the Babcock and Wilcox Company. Both are past-presidents of the society.

DR. IRVING LANGMUIR, associate director of the General Electric Research Laboratory at Schenectady, has been awarded the Fourth Order of the Rising Sun by the government of Japan, where he recently delivered a series of six lectures for the Iwadare Foundation of the Japanese Institute of Electrical Engineers. The decoration is bestowed by Japan in recognition of distinguished service. Two of these lectures were given in each of the following subjects: "Fundamental Industrial Research," "Surface Chemistry" and "Electric Discharges in Vacuum and Gases at Low Pressures."

A FAREWELL dinner has been given to Dr. William H. Wilmer by the boards of trustees of the Johns Hopkins University and of the Johns Hopkins Hospital in Baltimore. Dr. Wilmer, who retired as director of the Wilmer Institute of Ophthalmology in July, is returning to Washington, D. C., where he practised medicine from 1889 to 1925. He was professor of ophthalmology at Georgetown University School of Medicine from 1906 to 1925. In attendance at the dinner were Dr. Daniel Willard, president of the board of trustees of the university; Mayor Jackson; Herbert L. Satterlee, of the board of the Wilmer Foundation, and Mrs. Henry Breckenridge, originator of the foundation. Newton D. Baker, Cleveland, formerly Secretary of War, was toastmaster, and speakers included Dr. George E. de Schweinitz, emeritus professor of ophthalmology, University of Pennsylvania School of Medicine, Philadelphia, and Dr. William H. Howell, director emeritus of the School of Hygiene and Public Health of the Johns Hopkins University. The dinner was held in the hall of the Welch Medical Library.

THE Adolf Fick prize was recently awarded to Hans Spemann, Freiburg im Breisgau, by the Physico-Medical Society of Würzburg. According to *Nature*, the prize, which consists of 1,000 marks with a silver portrait medal of the physiologist Adolf Fick (1829–1901), was founded by his sons in 1929 in commemoration of the centenary of his birth. It is awarded to any member of a German-speaking country for the most important publication on a physiological subject during the last five years, with the proviso that "the competitor has not shown any anti-German activity or committed any anti-German action." On the occasion of the presentation of the award Dr. Spemann gave the results of experimental investigations on "A Theory of Development."

DR. ERNST F. W. ALEXANDERSON, consulting engineer of the General Electric Company, known for his contributions to radio, has been elected to membership in the Royal Academy of Science of Sweden.

THE degree of doctor of science was conferred on November 22 by the University of London on Dr. Karl Pearson, professor emeritus, formerly Galton professor of eugenics and director of the Francis Galton Laboratory for National Eugenics.

THE honorary degree of master of arts has been conferred by the University of Cambridge on Dr. W. P. Wynne, emeritus professor of chemistry in the University of Sheffield, who is now resident in Cambridge engaged in research at the Chemical Laboratory.

DR. HERBERT U. WILLIAMS, professor of pathology and bacteriology at the University of Buffalo School of Medicine, has retired after forty years of teaching. Dr. Kornel Ludwig Terplan, research professor of pathology since 1930, has succeeded Dr. Williams.

THE University of Liverpool has conferred the title of professor emeritus upon Dr. J. M. Beattie, formerly professor of bacteriology, and upon Dr. John Hay, formerly professor of medicine.

DR. OSCAR M. GILBERT, associate professor of medicine at the University of Colorado, was made emeritus professor of medicine following his recent resignation. He has been connected with the school since 1900.

O. T. ZIMMERMAN, formerly research chemist, School of Dentistry, University of Michigan, has become research chemist and chemical engineer with the Detroit Dental Manufacturing Company.

WILLIAM A. JENNER, of Potsdam, N. Y., has been appointed director of the Bureau of New York State Institution Farms by Charles H. Baldwin, State Commissioner of Agriculture and Markets. He succeeds E. C. Pooler. Mr. Jenner has for two years been assistant director. The bureau supervises the activities of forty-five state-owned and twenty-four state-rented farms.

F. H. ABBOTT, of the dairy industry division of the University of California, at the branch of the College of Agriculture at Davis, is chairman of a committee named to draft laws to present to the next legislature to enable the dairy industry of the state to carry out marketing agreements. G. E. Gordon, dairy specialist of the Agricultural Extension Service, and M. R. Benedict, acting head of the Giannini Foundation, also are members of the advisory drafting committee.

J. R. MOFFATT has been appointed farm manager at the Rothamsted Experimental Station in succession to the late H. G. Miller. For the past two years Mr. Moffatt has worked on the Rothamsted farm, first as recorder and assistant manager, then as temporary manager during the illness of Mr. Miller.

THE British Medical Research Council has appointed F. J. Marquis and Professor W. W. Jameson to fill vacancies in the membership of its Industrial Health Research Board.

WITH the cooperation of the Mexican government E. A. Goldman and L. J. Goldman, of the Bureau of Biological Survey, are undertaking a three-month study of waterfowl conditions in Mexico, where large numbers of the migrant birds that breed in Canada and the United States spend the winter. It is expected that the investigation will yield information that will be valuable in framing legislation for the protection of the waterfowl in the United States and Mexico.

DR. HAROLD ST. JOHN, professor of botany at the University of Hawaii, recently returned to Honolulu from a six-months' expedition to isolated South Sea Islands, made, with other investigators, in an 88-foot Bishop Museum sampan. The trip covered a 9,600-mile route which included the Tuomotus, Mangareva, Pitcairn, Rapa and Austral islands. Thirty-one island groups were visited and landings were made on more than one hundred different islands. Collections made for the Bishop Museum included more than 15,000 sheets of plant specimens.

DR. FREDERICK A. SAUNDERS, professor of physics at Harvard University, has been granted leave of absence for the second half of 1935–36.

DR. LIVINGSTON FARRAND, president of Cornell University, sailed from New York on December 20. He plans to inspect, at the request of the Carnegie Institution, the Mayan ruins of Yucatan.

DR. HUGH S. CUMMING, surgeon-general of the United States Public Health Service, returned on December 18 after visiting Buenos Aires to attend the ninth annual Pan-American Sanitary Conference.

A COMMITTEE, under the direction of Dr. Largret, of the Pasteur Institute at Tunis, has gone to French East Africa to study methods of inoculating against yellow fever.

IT is expected that Dr. J. B. S. Haldane, professor of genetics in the University of London, will lecture in the United States during the winter. The general subject of his lectures is announced to be "Science, Morals and Religion."

PROFESSOR CASSIUS JACKSON KEYSER, of Columbia University, spoke on "Mind, the Maker, the World Theory of the late William Benjamin Smith," at Teachers College, Columbia University, on December 10, under the auspices of The Forum of the Friends of Scripta Mathematica.

FRANCES DENSMORE, collaborator of the Bureau of American Ethnology, lectured on December 14 before the Mayo Foundation chapter of the Sigma Xi Mayo Clinic, Rochester, Minnesota. Her subject was: "Medical Practises of the Chippewa and Other Indian Tribes."

THE Western Society of Naturalists and the Society for Experimental Biology and Medicine, Southern California Section, will hold meetings at the Scripps Institution of Oceanography of the University of California on December 27, 28 and 29. The society has a membership of about 200. The meeting will include presentation of 25 scientific papers, and two symposia. One symposium on host-parasite relations will be led by Professor C. A. Kofoid, of the department of zoology at Berkeley. The second will deal with micrometabolism, and will be led by Professor H. S. Reed, of the Riverside Citrus Experiment Station. Professor William E. Ritter, director emeritus of the Scripps Institution, will make an address on

"What Charles Darwin did and what he left undone." The meeting of the Society for Experimental Biology and Medicine will be held on December 28.

THE Colorado Wyoming Academy of Science met on November 30 and December 1, at the Colorado School of Mines, Golden, Colorado. Section meetings were held in chemistry, education, geology, geography, physics, plant science and zoology. One hundred and forty papers were presented. Exhibits of teaching equipment, experiments and apparatus were set up for observation. The annual dinner was addressed by President George Norlin, University of Colorado. His subject was "Nationalism and Truth." Officers elected were as follows: *President,* E. B. Renaud, University of Denver; *Vice-president,* J. H. Johnson, Colorado School of Mines; *Secretary,* R. J. Gilmore, Colorado College; *Treasurer,* C. T. Hurst, Western State College; *Chairman Program and Publication Committee,* C. A. Hutchinson, University of Colorado. *Executive Committee:* T. R. Garth, University of Denver; F. P. Goeder, Colorado State College; P. E. Boucher, Colorado College; Laura A. White, University of Wyoming; C. F. Poe, University of Colorado; S. H. Knight, University of Wyoming. The 1935 meeting will be held at Colorado College, on November 29 and 30, 1935.

THE American Society of Agronomy at its recent meeting in Washington assumed the sponsorship of an award of $5,000 to be made annually by the Chilean Nitrate of Soda Educational Bureau, for work dealing with the importance of the rarer elements in agriculture. The first award will be made next year at the time of the annual meeting of the society. Professor R. I. Throckmorton, of the Kansas State College, is chairman of the special committee appointed to draw up the regulations of the contest.

A PRIZE of a gold medal and a thousand crowns has been offered by the Royal Academy of Sciences and Letters of Denmark for a study of Eskimo origins.

AN Associated Press dispatch reports that the University of Pennsylvania on December 9 announced the adoption of a definite policy of prohibiting the patenting for profit by any one connected with it of any invention or discovery affecting the public health. The university or individuals in its employ will not be permitted to patent new drugs, process or apparatus invented or discovered which "are intended primarily for medical or surgical use." Dr. Thomas S. Gates, president of the university, pointed out that it has not been the practise of the university or its employes to patent such discoveries, but there has never been a definite ruling previously.

THE University of Maryland, in cooperation with the Maryland Nurserymen's Association, has established a complete collection of typical plants on a newly acquired property which adjoins the university campus at College Park. Much interest is said to be manifested in the new project and many individuals and organizations have assisted by donating seeds and plants for its establishment. The work is under the direct supervision of A. S. Thurston, professor of floriculture and landscape gardening at the university.

THE final accounting of the estate of the late Frank Lusk Babbott has been filed. Mr. Babbott, who died on December 7, 1933, left all but $615,680 of his net estate of $4,094,156 to charities and educational institutions. Specific legacies amounting to $240,000 were made in the will to public agencies, and the residuary estate, estimated at more than $3,000,000, was divided among Amherst College, Vassar College, Long Island College Hospital, Long Island College of Medicine and Brooklyn Hospital. The specific bequests were Brooklyn Institute of Arts and Sciences, $100,000; Packer Collegiate Institute, Y. W. C. A., Memorial Presbyterian Church and Brooklyn Bureau of Charities, all of Brooklyn, $25,000 each; Waterville Public Library, Waterville, N. Y., $25,000; the First Presbyterian Church, Waterville, $25,000; Amherst College, $20,000. Vassar College's share of the residuary estate amounted to $540,000, and the Long Island College of Medicine announced last month that it had received $1,500,000 under the residuary clause. The bequest to Amherst College under the same provision of the will was said by the college authorities to be $1,100,000.

ALLOCATION of $10,000,000 of Emergency Conservation work funds to be used for purchase of additional lands for the National Forests has been made by executive order of President Roosevelt. This is the second such allocation of emergency funds, the first having been made on July 21, 1933, when $20,000,000 was provided, making possible the purchase of more than 6,000,000 acres of forest lands in the last eighteen months. These lands have been placed under the administration of the Forest Service, U. S. Department of Agriculture. Purchases already approved by the commission have exhausted the first allocation, and the $10,000,000 is transferred expressly for the purpose of continuing the acquisition program. The tracts to be purchased are examined by the Forest Service and are selected for their value as national forest land. Upon approval by the commission they become immediately available for management by the Forest Service and for work projects employing men of the Civilian Conservation Corps and local woodsmen. Purchases are also made with reference to local wood-working industries and uses that will tend to improve or continue employment in local communities.

DISCUSSION

A PHOTOCHEMICAL ASPECT OF NITRATE ASSIMILATION IN PLANTS[1]

THE prominence of nitrate as a form of soil nitrogen absorbed by plants confers fundamental significance upon the mechanism of reduction and assimilation in respect to this nutrient. It has been a matter of general recognition that this function is dependent upon participation of sugars or other compounds derived through photosynthesis, and that it bears a complementary relation to respiratory activity of the tissues. With a collaborator the authors have reported[2] a relatively direct effect of shorter visible light rays and longer ultra-violet radiation in promoting the absorption of nitrate by young plants of wheat (*Triticum sativum*) and tomato (*Lycopersicum esculentum*). Attention has since been given to the mechanism by which this light stimulus is made effective. The procedures followed were based upon the assumption that appreciable differences in the nature and content of reducing compounds might arise under exposure to short wave radiation. Inasmuch as the technique of producing the plants and the analytical methods employed are to be described in a later paper, only a summary statement is presented here.

It was found that blue to violet light increases the percentage of protein in the young wheat plant, while causing a decrease of pentosan. These changes are attended by a limited decrease of cellulosic compounds (crude fiber) and limited replacement of the nitrate by the nitrite form of nitrogen. More marked changes in these directions occurred under the influence of solar ultra-violet radiation, and in addition there was an increased percentage of lipides (ether extract) in the dry matter. The general picture of tissue conditions at this point is one of nitrate assimilation at the expense of carbohydrate reserves, with alcoholic constituents among the lipides somewhat favored by the shorter radiations.

Further investigation indicated that the content of a factor or factors responding to the conventional oxidimetric determination of glutathione, but insoluble in 50 per cent. alcohol, was consistently increased in both leaf and stem of wheat and tomato and the leaf of the soy-bean (*Glycine hispida*, stems not tested) by both the shorter visible and long ultra-violet radiations. This response was accompanied by increase in the percentage of uronic acids, as determined in the acidic extract of hemicellulose.

These results are in accord with results previously reported from this laboratory[3] for various species reared under vita glass, to the extent that the latter contained increased percentages of nitrogenous compounds and lipides as compared with controls receiving less solar ultra-violet under common glass. While it is hardly to be supposed that the isolated observations above recorded are likely to account in full for increased nitrate assimilating capacity, and hence also for increased absorption of this nutrient, they appear to correlate with facts and concepts presented by other investigators. Ward[4] has shown that cystine, in distinction from several other amino acids tested by him, absorbs shorter visible rays of light as well as longer ultra-violet. A possible path for the production of the sulphydryl from the di-thio grouping by photoreduction is thus suggested. From the work of Szent-Gyorgyi[5] it appears that hexuronic acids are to be included in the reducing system of at least some plant species, and that at neutral reaction these are reduced by glutathione. There is thus present in plants irradiated by light of the wave-length range characteristic of sunlight, on liberal nitrate supply, a system capable of replacing oxygen in the latter nutrient. It seems well to emphasize the rôle of nitrate itself in maintenance of this system in view of the loss of nitrate absorbing power observed with the preparatory use of nitrate-free nutrient solution, as reported in our earlier work (1934). The suggestion emerges that the functioning of the system here considered, in association with other oxidizing-reducing systems, may account for the general depletion of hemicellulosic constituents observed under the influence of blue to middle ultra-violet light.

In accordance with reported experience and in agreement with properties of individual factors involved, this sort of system should lead to variability in nitrate assimilation with changes in such factors as pH of the nutrient medium, age of the plant and species tested. The rôle of hemicellulosic constituents here indicated is of particular interest in relation to the observation of Stahl and Shive[6] that nitrate absorption is most active in late vegetative activity of oats (*Avena sativa*) and buckwheat (*Polygonum fago-*

[1] Published with permission of the director of the Wisconsin Agricultural Experiment Station. Supported by grants from the Committee on Effects of Radiation upon Living Organisms, Division of Biology and Agriculture, National Research Council.

[2] *Plant Physiol.*, 7: 551, 1932; 9: 127, 1934.

[3] *Jour. Agric. Res.*, 43: 133, 1931; SCIENCE, 75: 223, 1932.

[4] *Biochem. Jour.*, 17: 898, 1923.

[5] *Biochem. Jour.*, 22: 1399, 1929; *Jour. Biol. Chem.*, 90: 385, 1931.

[6] *Soil Sci.*, 35: 375, 469, 1933.

pyrum), or coincident with extensive elaboration of hemicellulose.

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OCCURRENCE OF UNIOVULAR TWINS IN MULTIPLE BIRTHS

ALTHOUGH there is no *a priori* basis for their non-existence, the presence of uniovular twins in the multiple births of laboratory mammals is for obvious reasons usually difficult to detect. Wright,[1] describing an eight-factor cross in guinea pigs, reported two pairs which may have been identical twins, but since the number was no greater than that expected by chance their status remained uncertain.

In the back-cross generation of a mouse species cross, involving *Mus musculus*, with the recessive genes d, b and a, and *Mus bactrianus*, with the corresponding dominant allelomorphs D, B and A^w, eight color combinations are expected in equal numbers. With but slight deviations this has been realized.[2] In a litter of a given size the expected frequency of like-sexed pairs, due simply to chance, can be computed by the elementary rules of probability. For example, in a sub-litter (like-sexed litter mates) of two, the probability that both will be of the same color is $\frac{1}{8}$, while in a sub-litter of three the expectation for a pair is $\frac{1}{4}$, etc. Then by the appropriate multiplication and combination of probabilities, the approximate total number of pairs of like color in sub-litters of every size encountered can be obtained. In the summary given the relatively few instances of three litter mates of the same sex and color were disregarded, although the two examples of a pair and three and the single one of a pair and five were considered as two pairs and three pairs, respectively.

SUMMARY OF OBSERVATION ANE EXPECTATION. UNDEPLETED LITTERS ONLY

Mating	Size of sub-litters	No. sub-litters	No. mice	No. mice in like-colored pairs		Deviation
				Observed	Expected	
F_1 ♀ × dba ♂	2–9	174	626	206	165 ± 7.4	+41
dba ♀ × F_1 ♂	2–7	100	312	76	68 ± 4.9	+ 8

In the back-cross offspring of F_1 females there is a significant excess (5.5 P.E.) of litter mates of the same sex and color, while in the progeny of F_1 males the observed numbers are but little greater than the expected. Since the hybrid females are characterized by large litters and paucity of still births[3] it seems probable that this excess can be accounted for by uniovular twins which the unusual vigor of the mother has permitted to survive but which ordinarily would never have begun development or would have succumbed in prenatal competition. If this surplus consists of such twins, more like-colored pairs of the same sex than of different sex should be found. Such was the situation, for, compared with the 103 like-sexed in pairs in mice from F_1 females, there were only 79 pairs of unlike sex, while the comparable figures for back-cross animals from F_1 males were 38 and 40, respectively.

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A BLUE MOON

THE writer observed a blue moon at Santa Barbara, California, on September 15, 1934, and a search for records of this phenomenon indicates that it is rare and worth recording. The stage of the moon was about the end of the first quarter. At 6:15 P. M., about eight minutes after sunset, the moon was plainly visible through a bank of thin rose-colored clouds, apparently cirro-cumulus. Around the cloud bank the brightly-illuminated western sky was a brilliant deep blue. Four witnesses were called by the writer and all agreed that the moon was blue. Two weeks later an attempt was made to remember the colors and to find their designations in Ridgway.[1] The results of this belated comparison are that the sky was spectrum blue; the cloud bank, begonia rose; the moon, sky blue.

Reference is made by Stimpson[2] to a blue moon seen on December 10, 1883, and to many observers who saw one in Ireland in 1927, during a total eclipse of the sun. He states also that "moons of unusual colors, such as green and blue, have been seen after certain violent volcanic explosions, and also occasionally through smoke-laden fogs."

Of related interest are references by Talman[3] to blue and green suns. Such suns were widely observed during the summer and autumn of 1831, in the northern hemisphere, and after the eruption of Krakatoa in 1883. No satisfactory explanation of the colors has been advanced.

PEREZ SIMMONS

FRESNO, CALIF.

[1] Wright, *Genetics*, 13: 508–531, 1928.
[2] Green, *Am. Nat.*, 66: 87–91, 1932.

[3] Green, *Proc. Soc. Exp. Biol. and Med.*, 28: 55–57, 1930.

[1] R. Ridgway, "Color Standards and Nomenclature," 1912.

[2] G. W. Stimpson, "Nuggets of Knowledge," 427 pp., 1929. See discussion of "How did *once in a blue moon* originate?"

[3] C. F. Talman, *Science Service Feature* (mimeograph), 1 p., April 17, 1930.

SCIENTIFIC BOOKS

A TREATISE ON DIFFRACTION

The Diffraction of Light, X-rays and Material Particles. By CHARLES F. MEYER. University of Chicago Press, pp. 473 + xiv with 283 figs., $5.00, 1934.

THE theory of light diffraction is often encumbered with more mathematics than is essential to an understanding of most of the observed phenomena. The simple theory of Fresnel explains most observations. The dynamical theory of Kirchhoff is much more difficult in application, and yet it can not yield rigorously correct results. In practise it gives results which are very like those of the Fresnel theory. The rigorous theory of Sommerfeld has been applied to only the simplest cases. Even then it has been found necessary to assume perfect conductivity of the diffracting screen, and thus its predictions regarding the intensity of light diffracted at large angles do not agree very well with observation.

The Fresnel theory is made the basis of the chapters on the diffraction of light in this treatise by Professor Meyer. The treatment is thus made relatively simple. There is, however, no lack of thoroughness. The logical limitations of the treatment are clearly pointed out, and in a later chapter are considered the conditions under which it may be expected to be inapplicable. The dynamical theories of Kirchhoff and Sommerfeld are briefly described in this latter place.

The author states that portions of this book are suitable as a test for students of optics and that more mature physicists are offered here a novel and improved exposition of the subject. It is the opinion of the reviewer that the presentation is well suited to both classes of readers. The treatment is simple, unusually well arranged and clearly written, and is sufficiently comprehensive to be somewhat of an encyclopedia of the subject of light diffraction. The diffraction of x-rays and material particles are treated rather less exhaustively in the last third of the book.

The first chapter consists of a historical summary of the diffraction of light, beginning in the seventeenth century with Grimaldi and ending with Planck in the twentieth century. To a considerable extent the historical method of this introductory chapter is followed throughout the book, and references to original papers are always given. These are usually accompanied by other references to later systematic treatments. The references seem to the reviewer to be very happily chosen. They are never burdensome in number, and there is usually a brief discussion of their relative values.

The theory of light diffraction occupies eighty-four pages. Following this comes a long and comprehensive chapter on "The Diffraction Grating." This chapter contains a great deal of material which has not been gathered together elsewhere. It is sufficiently detailed to be valuable to a spectroscopist. This is perhaps the only portion of the book which contains more material than one ought reasonably to expect to find as part of the mental equipment of an average physicist—at least of an "ideal average physicist."

To the reviewer the most interesting part of the book is a long chapter entitled "Sundry Ramifications of Diffraction Theory." In this chapter are considered various interesting subjects which are presumed to be a part of the stock in trade of every physicist, but which are nevertheless not all readily available elsewhere. These subjects include the resolving power of optical instruments, Abbe's theory of microscopic vision, meteorological phenomena and the measurement of star diameters. It seems to the reviewer that the average physicist should be well acquainted with the miscellaneous subjects of this chapter, and that the treatments given here are about right in extent for one who is not a specialist in some branch of optics. In fact this remark applies rather well to the entire book.

The chapter on x-ray diffraction begins with an excellent historical review of this subject. Only so much of the elements of crystal structure is given as seems essential to understanding the different methods of crystal structure analysis. This saving of space allows a presentation of the elements of x-ray diffraction and x-ray spectroscopy in eighty-three unhurried pages. This presentation covers more of the details than one might expect, and is withal a neat feat of exposition.

The last chapter, "The Diffraction of Material Particles," follows the historical development of its subject even more closely than do the other chapters of the book, and in some cases in more minute detail than seems justified. The chapter is, however, only fifty-three pages in length and the subjects which are treated have been well chosen.

L. H. GERMER

BELL TELEPHONE LABORATORIES
NEW YORK, N. Y.

BOOKS ON POPULAR ASTRONOMY

Leaflets. ASTRONOMICAL SOCIETY OF THE PACIFIC. Volume I, Numbers 1 to 50, 11 × 18 cm, viii + 206 pages, 1934. Price, $2.25.

THESE important leaflets owe their origin to the suggestion of an amateur astronomer, Mr. Bernard Benfield, of San Francisco, by whom also they were edited in collaboration with the secretary of the society, Mr. C. H. Adams. In four small but closely printed pages each of them is a chapter on some interesting topic and gives the well-considered views of a worker in that particular field. The publication

of these leaflets will in all probability become a permanent activity of the society. In the present volume the first fifty, separately distributed from 1925 to 1933, have been collected into a handy volume with a foreword by Dr. Aitken, director of the Lick Observatory. The reviewer commends the volume to the attention of teachers of science and to all others who, starting with some knowledge of astronomy, wish to keep themselves informed as to recent developments. Most of the leaflets have been written by astronomers at one of the great institutions in California, but occasionally the editors have come east for their authorities and in two instances have even crossed the Atlantic Ocean. All of them are written in clear non-technical language and much thought has been given to making them as serviceable as possible to the general reader.

Dix Leçons d'Astronomie. By E. ESCLANGON. Second edition. 115 pages, 14×21 cm. Gauthier-Villars et Cie, Paris, 1933. Price, 25 francs.

THIS little book, written by the director of the Paris Observatory, gives in simple and eloquent language a rapid review of the whole science. This task is skilfully performed, and the book will be read with profit and pleasure by those for whom simple French is not difficult. It has been used more than once by graduate students in this country who wish to improve their knowledge of scientific French and is excellent for this purpose.

When the Stars Come Out. By ROBERT H. BAKER. ix+188 pages, 14×21 cm. The Viking Press, New York, 1934. Price, $2.50.

THIS work is one answer to the astronomer's prayer for a simple but authoritative exposition to which he can refer young readers and their parents. The make-up of the book is especially attractive; the star charts and numerous excellent illustrations have dark blue backgrounds that are not a bad imitation of the color of the night sky. The high standard of accuracy and clarity that the author has established for himself in his two earlier popular expositions is well maintained in this.

Handbook of the Heavens. Edited by H. J. BERNHARD. 54 pages, 16×23 cm. Published by the Junior Astronomy Club of the American Museum of Natural History, New York, 1934. Price, $0.50.

THIS handbook, reproduced from typewritten manuscript by a photo-offsetting process, is chiefly a guide to the constellations, with clear instructions and numerous charts for finding and identifying them. In addition, the book indicates what objects are suitable for observation with field glasses and small telescopes. There are very few errors of statement or printing. A pleasant feature of the printing is the justification of the lines so that all of them come accurately to the right-hand edge; this is done by using a typewriter that has a device for introducing spaces of various widths. The number of characters in each line of the manuscript must then either be carefully counted, or better, the typewriting is done twice.

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TIMBERS OF NORTH AMERICA

Identification of the Timbers of Temperate North America. By SAMUEL J. RECORD. Pp. i–ix+196. John Wiley and Sons, Inc. 1934.

THE first edition of Record's "Identification of the Timbers of Temperate North America, including Anatomy and certain Physical Properties of Wood" represents a complete rewriting and recasting of the material earlier treated in his "Economic Woods of the United States" and extends it to include the timbers of all temperate North America. As before, the book is divided into two parts, Part 1 treating of "The Anatomy and Certain Physical Properties of Wood," and Part 2 of "Timbers of Temperate North America." This book, as now available, is excellently illustrated, includes introductory material on the essentials of development and of xylem anatomy and is followed by a key to the woods of timber trees of North America as well as comments on their distribution and uses. The bibliography has been brought up to date.

In more detail, Part 1 has been written around the recent "Glossary of Terms Used in Describing Woods," published in *Tropical Woods,* No. 36, December 1, 1933. This glossary was compiled by a Committee on Nomenclature of the International Association of Wood Anatomists in a first attempt to standardize terms used in the description of woods. Dr. Record has fitted these terms into an excellent treatment, well illustrated, of the developing and mature xylem, a treatment which might well be utilized in any course in plant anatomy. Tables, increased in number, of statistical matter concerning size of xylem elements, distribution of parenchyma, types of vessel perforation, specific gravity of woods, etc., are now found in this part of the text instead of in an appendix as before.

Part 2 comprises a key to the timbers of North America as well as comments on each genus and species referred to in the key. The major differentiation of the woods is made on characteristics to be observed in macroscopic study or in free-hand sections. Microscopic details are indicated in smaller

type. The key has been modified and the new terminology of Part 1 introduced into the descriptive material. The "Notes and References" following the key give comments on the geographical distribution and the economic significance of the species concerned.

This book represents a decided contribution, valuable to botanists, to foresters and to all those interested in North American woods.

R. H. WETMORE

HARVARD UNIVERSITY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

WATER-COOLED RESISTORS

THERE are numerous occasions when a resistor of high current-carrying capacity is needed in the laboratory; for example, in regulating the current of electric furnaces, in charging large storage batteries and in testing the regulation of some generators. It is the purpose of this note to describe two types of water-cooled resistors which are extremely simple and cheap to construct and which have been found satisfactory. Probably resistors of this type have been employed by others, but since their value and simplicity do not seem to be generally known, a description of them may be of interest.

The resistor is essentially a piece of wire of high specific resistance located inside of a tube through which water flows. Fig. 1 shows the construction of a fixed resistor. The tube consists of two pieces of copper tubing, C and C′, joined by a section of rubber tubing, R. A wire of nichrome, N, is soldered to the inside surfaces of the copper tubes and the external leads, L and L′, are soldered to their outside surfaces. Of course, the rubber tubing must be doubled back upon itself during the soldering process in order that it will not be injured by excessive heating. If heavy rubber tubing is employed, so that difficulty is experienced in doubling it back upon itself, it is easier to use two pieces of it joined by a piece of glass tubing. The rubber can be pushed back over the glass while soldering and then pulled back to join the copper.

Fig. 1

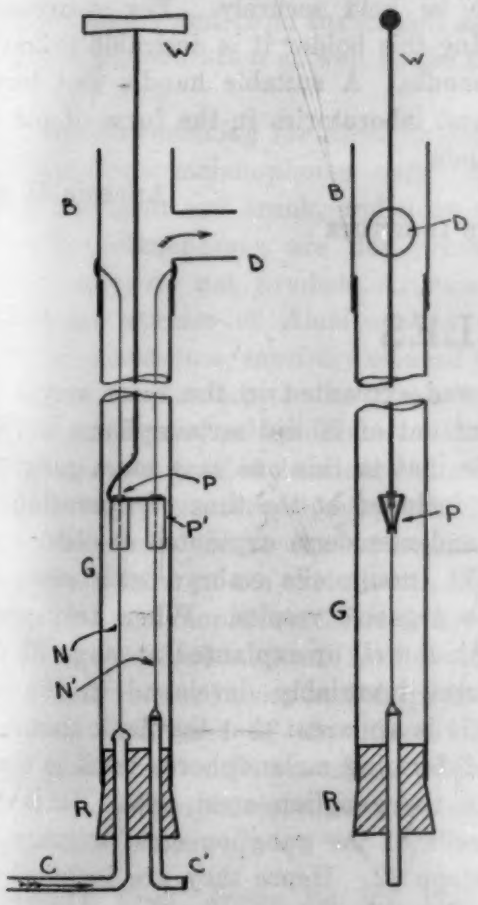

Fig. 2

Fig. 2 shows two views of a variable resistor which has proved satisfactory. G is a large glass tube arranged vertically, B a piece of brass tubing and R a two-hole rubber stopper. C and C′ are pieces of copper tubing which serve as the terminals of the resistor composed of two pieces of nichrome wire, N and N′. Cooling water flows in at tube C and out at tube D. P and P′ are phosphorbronze clips which are connected to a piece of heavy copper wire, W, by which they can be moved along the resistor, thus varying the resistance between C and C′. The upper end of W is insulated so that the operator will not receive a shock.

Nichrome can be obtained in straight wire, in helically wound wire and in flat ribbon. The variable resistors must be made of straight wire or ribbon, but the fixed ones can also be made of helical wire, thus keeping them small. No. 22 straight wire, having a resistance of approximately one ohm per foot, is readily obtainable. When water-cooled, it can carry 40 amperes safely. The quantity of cooling water required depends upon the power dissipated by the resistor. A flow of one liter per minute is ample for a resistor dissipating two kilowatts or less.

Any number of either fixed or variable resistors can be connected together so that the cooling water flows through them successively. They can then be connected electrically either in series to give a higher resistance or in parallel to give a greater current-carrying capacity. The entire group of resistors should be connected to the water supply with rubber or glass tubing so that they will be insulated from ground.

It is well to provide means for opening the circuit automatically in case the cooling water is accidentally shut off to prevent the resistor from burning out. This can be done readily by connecting in series with the resistor a short piece of the same wire of which it is made and placing this piece so that it is within the stream of water issuing from the end of the resistor when the flow is normal but is out of the stream when the flow is reduced. By varying the angle which the emerging stream of water makes with the vertical and the distance of the piece of wire from the orifice any desired sensitivity can be had. With proper adjustment, this piece of wire will function as a fuse, burning out before the water has quite stopped flowing and thereby protecting the resistor.

No careful study of the durability of the resistors has been made. The following tests will, however, serve to show that their useful life is reasonably long. A fixed resistor made of No. 22 wire carried 20 amperes for 20 hours and then 25 amperes for 20 hours more. At the end of the test, it was in perfect condition and its resistance had changed by only about ½ per cent. A variable resistor carried 25 amperes for 20 hours and was operating satisfactorily at the end of the test. Other resistors have given satisfactory service in the laboratory for longer times, but no record of their performance has been kept.

EDWARD M. THORNDIKE

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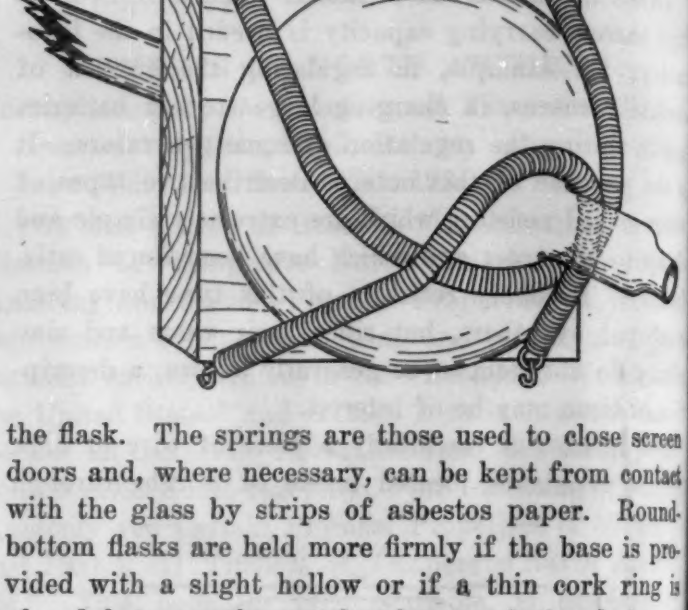
GLASS BLOWERS' HOLDER FOR LARGE FLASKS

THE holding of flasks, larger than a liter, in glass-blowing operations is usually a troublesome matter. The ordinary snap type of holder is not generally supplied in these sizes. An extremely simple device which the writer has found to be quite satisfactory is depicted in the accompanying sketch and requires only a few explanatory comments.

The flask is held against the base by two long U-shaped springs, which are looped over the neck of



the flask. The springs are those used to close screen doors and, where necessary, can be kept from contact with the glass by strips of asbestos paper. Round-bottom flasks are held more firmly if the base is provided with a slight hollow or if a thin cork ring is placed between the wooden base and the flask. A cork ring around the neck of an erlenmeyer flask will keep the springs from slipping down and permit such a flask to be held securely. For convenience in manipulating this holder it is desirable to have a detachable handle. A suitable handle and base is at hand in most laboratories in the form of old wooden funnel stands.

ARTHUR F. SCOTT

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SPECIAL ARTICLES

THE ORIGIN OF PIGMENT CELLS IN AMPHIBIA

IN the present study the methods of transplantation and explantation have been employed to decide between the divergent views that have been held regarding the origin of pigment cells in the amphibian embryo—whether from connective tissue, leucocytes, epidermis or ganglion crest. Embryos of *Amblystoma punctatum*, *A. tigrinum* and *A. mexicanum* (axolotl, both black and white) have been used in the experiments.

Explantation experiments: Pieces of the neural folds (anlagen of the ganglion crest) from the trunk region of *A. punctatum* neurulae were explanted into Holtfreter's solution. Melanophores appeared in every explant within six days (37 cases). Prospective flank ectoderm was explanted in the same way. In only one explant out of 20 did melanophores develop. It is probable that in this one case some ganglion crest cells were included at the time of operation. Flank ectoderm and mesoderm explanted at older stages up to stage 32 (non-motile embryo with elongated tail bud) gave negative results. When transplanted to the abdominal wall or explanted at stage 32 or older, melanophores invariably developed in the graft or explant. It is apparent that the flank tissues are not capable of forming melanophores until a much later stage than the ganglion crest cells. It is probable that the cells of the ganglion crest migrate into the flank at stage 32. Hence they are included in flank explants after this stage.

Defect experiments: The neural folds in the trunk

region of *A. tigrinum* and *A. punctatum* neurulae were removed bilaterally. In these cases melanophores, xanthophores and the dorsal fin failed to develop in the entire trunk of the embryo, while the head and tail were normally pigmented. This experiment is similar in results to a slightly different experiment by Holtfreter on Triton,[1] and affords striking evidence in favor of the ganglion crest origin of pigment cells.

Heteroplastic transplantations: Dorsal ectoderm of the trunk region with the adhering neural crest cells was transplanted between *A. punctatum* and *A. tigrinum* and from black axolotls to *A. punctatum.* All operations were performed on tail bud stages. Melanophores and xanthophores of the donor type appeared in all grafts from the axolotl to *A. punctatum* and from *A. tigrinum* to *A. punctatum.* The graft areas were easily distinguished from the host skin by the pigment differences which were maintained throughout larval life and after metamorphosis. In the grafts from *A. punctatum* to *A. tigrinum* melanophores of *A. punctatum* (donor) type developed in 9 out of 17 cases. In all cases they were replaced by melanophores of tigrinum (donor) type before metamorphosis. Flank or limb ectoderm and mesoderm transplanted between any of these species at tail bud stages acquires host pigmentation[2] in contrast to the results with dorsal ectoderm and neural crest cells. However, limbs transplanted to *A. punctatum* from *A. tigrinum* at older stages (stage 38, limb bud beginning to elongate) and from the axolotl at stage 34–37 develop the pigmentation as well as the size and form of the donor limb.

Experiments involving the white axolotl: The white axolotl develops melanophores only on the dorsal parts of the head and trunk, and none on the flank. Epidermal melanophores are not present, and the epidermal cells do not produce melanin as they do in pigmented species of Amblystoma. Flank ectoderm of *A. punctatum,* carefully cleaned of mesoderm cells, was transplanted to the flank of the white axolotl. In all cases subepidermal melanophores appeared under the grafted ectoderm. Later epidermal melanophores and xanthophores appeared in the graft region. Ectoderm from the abdomen was transplanted to the flank of the axolotl with exactly similar results. The melanophores induced by the grafted ectoderm are undoubtedly of axolotl (host) origin since they are similar in size and shape to those of the host and not to those of the donor. Furthermore flank or abdominal ectoderm of *A. punctatum* never gives rise to melanophores when explanted or transplanted to the abdomen.

[1] Holtfreter, *Roux' Archiv,* Bd. 127, 1933.

[2] Harrison, SCIENCE, Vol. 74, found similar results in limb transplantations.

It is clear that there are subepidermal cells in the white axolotl which acquire melanin and become typical melanophores when the non-pigmented axolotl epidermis is replaced by the pigmented epidermis of *A. punctatum.* Harrison (unpublished data) has found that if Amblystoma ectoderm is grafted to the limb area of *Triturus torosus* melanophores appear under the graft long before they develop in the other limb. The relationship here is the same as that between *Amblystoma punctatum* and the white axolotl.

It is suggested that in both of these cases the transplanted epidermis supplies some substance or substances to the underlying cells which they utilize in melanin formation. In the light of Bloch's experiments[3,4] the substance supplied might be dopa or dopa oxidase, which would then react with the one or the other present in the underlying cells to form melanin.

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HYPERIMMUNE ANTIPOLIOMYELITIC HORSE SERUM[1]

WITHIN recent years various workers[2-7] have demonstrated the successful hyperimmunization of horses to the poliomyelitic virus. That a potent antiviral serum can thus be produced in a refractory animal is again indicated in the following report.

Three horses were inoculated over a period of 2½ years with 10 per cent. poliomyelitic virus filtered through a Berkefeld N candle. Four different strains of virus were used, 2 monkey passage and 2 isolated from human cases during the New York epidemic of 1931.[8] Injections were given both intracutaneously and subcutaneously at bi-weekly intervals for the first 3 months, reduced later to weekly periods with a dosage of 200 cc, given by the combined intramuscular and subcutaneous routes. Trial bleedings were taken several times and the serums eventually neutralized the virus in dilutions of at least 1–200 or 1–300. The

[3] Bloch, *Zeit. exp. Med.,* Bd. 5, 1917.

[4] Bloch, *Centralbl. f. Haut-u. Geschlects-Krankheiten.* Bd. 8, 1923.

[1] Supported by a fellowship grant from the Eli Lilly Company.

[2] M. Neustaedter and E. J. Banzhaf, *Jour. Am. Med. Assn.,* 68: 1531–1533, 1917.

[3] R. W. Fairbrother, *Brit. Jour. Exper. Path.,* 11: 43–53, 1930.

[4] A. Pettit and B. Erber, *Bull. de l'Acad. de méd.,* 107: 455–459, 1932.

[5] E. R. Weyer, W. H. Park and E. J. Banzhaf, *Jour. Exper. Med.,* 53: 553–566, 1931.

[6] E. W. Schultz and L. P. Gebhardt, *Proc. Soc. Exper. Biol. and Med.,* 31: 260–261, 1933.

[7] M. Schaeffer, *Proc. Soc. Exper. Biol. and Med.,* 31: 1232–1234, 1934.

[8] One strain of virus was kindly supplied by the laboratory of the New York City Department of Health and the other (Fl) by Dr. John Paul, of Yale University.

serum of 1 animal was invariably more potent than the others, neutralizing when diluted 1–400. Since equal parts of serum and virus suspension were used, the final dilutions were always double the original amounts.

At the end of 2½ months of immunization, a large bleeding was obtained from the animals and the pooled serum was sent to the Eli Lilly Company for concentration. Two lots of the refined material neutralized *in vitro* from 16 to 32 minimum infective doses of the potent monkey passage strain of virus obtained from Dr. M. Brodie, of the New York City Health Department, in a dilution of at least 1–1,000 to 1–2,000 but not 1–5,000, while the original unconcentrated pooled serum was potent only to a 1–500 dilution and not a 1–1,000. The strength was thus increased and not lost during the refining process. Intraperitoneal inoculation of 20 cc of the pooled concentrated serum into a monkey failed to give any reaction.

Neutralization also occurred when using a virus recently isolated during the 1934 outbreak of poliomyelitis in northern California. Cord removed at autopsy from a human case produced typical poliomyelitis in a monkey after eight days incubation and has since been carried through five passages in monkeys. The second generation virus was potent in a dilution of 1–400 of the 5 per cent. suspension.

The following experiments were performed to test the strength of the concentrated serum when used both therapeutically and prophylactically. 0.005 cc of a 5 per cent. suspension of virus (0.00125 cc M. I. D.) was inoculated intracerebrally into 4 monkeys. Three animals then received 25 cc of the concentrated serum intramuscularly 4, 5 and 6 days, respectively, after the infecting dose and during the prodromal period. The fourth received no serum. All 4 animals developed paralysis and succumbed to typical poliomyelitis. Only 1 was given a second dose of serum but without effect.

The concentrated serum was then tried prophylactically, the virus being administered intracerebrally in 1 series and intranasally in 2 others.

In Series I, 3 animals were given 10 cc and 3 others 20 cc of concentrated horse serum intramuscularly. 0.005 cc of virus were inoculated intracerebrally into 2 monkeys, respectively, 1, 2 and 9 days later. One control animal was used. Only 2 of the 7 monkeys survived, 1 receiving 10 cc of serum 24 hours previous to infection and another receiving 20 cc 2 days beforehand. Although the other 2 monkeys given 20 cc of serum succumbed to the disease, yet the incubation period was greatly prolonged, being 15 days, as compared to 8 days for the control animal. The serum apparently could be of some effect even after the drastic method of infection directly into the central nervous system.

In Series II, the same number of animals was given similar amounts of concentrated serum intramuscularly. Ten per cent. virus was administered by intranasal instillation according to the method of Schultz and Gebhardt[9] at 1, 2 and 7-day intervals. Two control monkeys were included. Two animals receiving the 10 cc amounts of serum died of intercurrent infections. Of the others, 1 control acquired the disease, while all the remaining animals survived.

In Series III, 3 monkeys received 20 cc of concentrated horse serum into the muscles and 3 others 25 cc each of unconcentrated immune sheep serum. Respectively, 1, 2 and 7 days later one of each group was given a 20 per cent. suspension of poliomyelitic virus by intranasal instillation, according to the aforementioned method. Three control monkeys were included. Two of the latter succumbed to the disease, as did also the treated animal receiving sheep serum 1 week previous to the virus. The incubation was prolonged to 19 days, however. All the others and 1 control survived. It seemed apparent that the serums were of some value when inoculated prior to the administration of the virus by the less severe intranasal route.

In summary—a potent hyperimmune antipoliomyelitic horse serum has been developed which may be increased in strength by concentration as demonstrated by the *in vitro* neutralization test. The concentrated serum was without effect if given therapeutically during the prodromal stage after intracerebral injection of monkeys, but was apparently of value if administered prophylactically. This was demonstrated mainly after intranasal infection and only in part after intracerebral inoculation of monkeys.

B. HOWITT

THE GEORGE WILLIAMS HOOPER FOUNDATION
SAN FRANCISCO, CALIF.

[9] E. W. Schultz and L. P. Gebhardt, *Proc. Soc. Exper. Biol. and Med.*, 30: 1010–1012, 1933.

BOOKS RECEIVED

CRANE, M. B. and W. J. C. LAWRENCE. *The Genetics of Garden Plants.* Pp. xvi + 236. 53 figures. Macmillan, London. 10s. 6d.

GURNEY, R. W. *Elementary Quantum Mechanics.* Pp. 160. 67 figures. Cambridge University Press, Macmillan. $2.35.

PRAEGER, ROBERT L. *The Botanist in Ireland.* Pp. xii + 587. 29 figures. 44 plates. Hodges, Figgis, Dublin. 12s. 6d.

Report of the Science Advisory Board, July 31, 1933 to September 1, 1934. Preliminary edition. Pp. 290. National Research Council, Washington.

SEARLE, G. F. C. *Experimental Physics.* Pp. xiv + 363. 129 figures. Cambridge University Press, Macmillan. $4.50.

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SCIENCE NEWS

Science Service, Washington, D. C.

EXPERIMENTS IN SEX CONTROL

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ONE of the first apparently successful attempts at experimental sex control of warm-blooded animals has been reported from the zoological laboratories of Indiana University.

Through injection and absorption of female sex hormones into more than 900 chick embryos, the normal sex ratio has been changed from about 50 per cent. females to 64.78 per cent. females. With more complete control of experimental conditions, it seems possible theoretically to control almost without exception the sex of the embryos. This means sex reversal from male to female. The next step in the experiment will be to attempt the more difficult change from female to male.

The possibility of experimental sex control has long been a subject of scientific investigation. Sex reversal has been accomplished experimentally in the amphibians and other cold-blooded animals but has baffled science in its efforts on warm-blooded species, although Professor F. A. E. Crew, of the University of Edinburgh, has reported a female fowl which laid eggs and later produced sperm.

Working for the past two years on the general problem of the effect of endocrine gland preparations on the development of the chick embryo investigators at Indiana University developed a theory of sex control through injection of sex hormones. They took advantage of the known fact that the gonads or sex glands of the chick embryo are practically identical so far as structure is concerned until about the sixth day of development. At that time sex differentiation occurs. Injection of hormones was started on the third or fourth day, when theoretically the gonad could be changed. The extract was inserted into the air chamber at the large end of the egg. Absorption was accomplished through the allantois of the embryo, a vascular membrane which takes up the extract.

The heavy percentage of females developing from the artificially treated embryos, as compared with the normal 50–50 ratio, seems indicative if not a proof of sex reversal. In answering the question of why the 900 embryos of the experiment showed any males at all, it is explained that the allantois or absorbing tissue of many males develops so late that the extract of female hormones is not absorbed under the present experimental methods. Another reason for failure to bring about complete sex reversal is that the shell membranes in many cases are so dry as to absorb all of the extract before it reaches the allantois of the embryo.

Continuing the injections after sex differentiation has taken place in the chick embryo, it has been found that the extract of female hormones produces an abnormality in the male glands, but that the change is not sufficient to produce reversal, once sex differentiation has definitely developed.

ATMOSPHERE OF THE PLANETS

LIFE on the other planets, with the possible exception of Mars, is absolutely impossible. This has been shown by observations at Lowell Observatory on Jupiter and Saturn which show their atmospheres to consist largely of methane and ammonia, deadly gases not widely found on earth.

Dr. V. M. Slipher and Arthur Adel, of the Lowell Observatory, Flagstaff, Arizona, have clinched the argument by the use of evidence gathered by planetary spectrum photographs taken through telescopes and laboratory spectra of the gases.

Ammonia is the familiar stifling, strongly odorous gas, and methane is the deadly hydrocarbon gas often called firedamp or marsh gas. Violent explosions in coal mines result from methane. Ammonia is used in artificial ice machines. The atmospheres of Jupiter and Saturn may be visualized as like the interior of a gassy mine mixed with an exploded ice factory, all at the immensely low temperature of some 220 degrees below zero Fahrenheit.

If a trip could be taken to Saturn or Jupiter, the great cold and the deadly gases would snuff out life. And if oxygen were taken along for breathing purposes, there would be a terrific explosion as soon as it arrived. This fact is proof that no oxygen exists upon the two planets. Although Uranus and Neptune, the two planets next beyond, are too distant and small to allow as detailed telescopic inspection, their light makes the astronomers feel sure that they too have methane-ammonia atmospheres with no possibility of life. This eliminates four out of nine planets as abodes of life.

Pluto, most distant and most recently discovered planet, is without atmosphere because like the earth's moon, and Mercury, the sun's nearest neighbor, it is too small and has too little gravity to hold on to gases.

Venus, with much atmosphere, can not have life unless it could exist without water or oxygen and thrive upon carbon dioxide, the waste product of respiration here on earth.

Life is more likely to exist on Mars than elsewhere in the solar system because it has visible clouds somewhat similar to those on the earth. The question of the existence of life-supporting oxygen is in dispute. It has water, but less than on earth. There seem to be seasonal changes. The temperatures vary from about 65 to 70 degrees Fahrenheit at mid-day to far below zero at night. Man could not live under such conditions, but some sort of odd lichens or fungi or strange Martian germs might.

The ammonia-methane composition of the atmospheres of the giant and distant planets was first hinted over two years ago by computations of Dr. Rupert Wildt, of Göttingen, Germany, using Lowell Observatory spectrographic observations. More recently, Dr. Theodore Dunham, Jr., of Mount Wilson Observatory, demonstrated conclusively the existence of ammonia. Dr. Slipher used the rich photographic data of Lowell Observatory, which

specializes on observations of the planets. These he compared with laboratory work at the University of Michigan on the way light is affected by high concentrations of methane. This gas was compressed so greatly that the light has a path equivalent to over a mile in length.

It is possible that Jupiter and Saturn may not have solid surfaces. Because of the great cold upon them the ammonia gas may freeze out in beautiful white crystals. One theory is that the different light-colored markings upon the two planets are due to great geyser-like wellings of the sub-frigid ammonia crystals.

The idea that the gigantic disturbances on the surfaces of Jupiter and Saturn are periodic and are in some way set off by the same unknown cause that influences the sunspots and the aurorae of the earth is advanced by Dr. E. C. Slipher, of Lowell Observatory.

THE NEUTRON

WHILE the newly discovered particle of matter, the neutron, has no electric charge that can be detected, it is thought possible that it may be composed of the close combination of a positive electric charge, the proton, and a negative electric charge, the electron. If this were true the neutron would not be an elementary particle but a stable combination of two things already known.

Professor Alfred Lande, of the Ohio State University, reported to the American Physical Society, meeting in Ann Arbor, that new considerations regarding the magnetic properties of atoms indicate that the negative charge is bound to the lighter of two things inside a neutron, while the positive charge is joined to the heavier part. Thus the neutron would be a particle which represents a working agreement between a proton and an electron.

The principal difficulty in considering a neutron as composed of an electron and a proton comes in a study of their weights separately and in combination. The sum of the masses of a proton and an electron would be 1.0072 plus .00055, or 1.00775. This figure is larger than the mass of the neutron, 1.0068, determined experimentally by Professor James Chadwick, of the University of Cambridge, but is smaller than the neutron mass, 1.010, as measured in Paris by Irene Curie and her husband, F. Joliot. If 1.010 is correct, physicists have been anticipating trouble, for they then would have two atomic objects weighing less in combination than their sum separately.

Dr. Lande's magnetic considerations, approaching the problem from another front, indicate that the neutron is a proton plus an electron and implies that the Curie-Joliot measures of 1.010 for the neutron mass may be in error.

DIET REQUIREMENTS OF AN AVERAGE MAN

DOES the average man doing an average day's work need to get more or less than 3,000 calories in his daily diet?

This is one of many questions in the field of nutrition which require further research, Professor Lafayette B. Mendel, of Yale University, told members of the American Home Economics Association, at the recent meeting of the society in New York City.

The 3,000-calorie requirement, now almost universally accepted, is based on precise scientific calculation of energy requirement made during the war. It is now under discussion because of the declining need of energy foods in this day of labor-saving devices. In England at present some favor increasing the calorie requirement to 3,400 with a reduction in the amount of protein foods. "This gives an incentive for further investigation into what the real working status of the coming generation is to be," Professor Mendel observed.

Another point requiring further research is the actual rôle of the vitamins in maintaining health. This is particularly important in relation to subacute disorders arising from partial rather than complete lack of certain essentials of diet. The malnutrition of certain types of alcoholism comes under this head. The problem of storage depots in the body for reserve supplies of vitamins, water, fats, mineral nutrients and other substances needs investigation. The conditions under which vitamin A is stored have already been examined and the results suggest that much of this vitamin may be destroyed in the digestive tract.

The value of roots, tubers, leaves and fruits is little understood. Fruitful field for research also lies in the direction of texture of foods, about which dentists are particularly concerned at present, and food allergy or sensitiveness.

ITEMS

LIGHTNING is to play the title rôle in an educational motion picture recently released by the General Electric Company. With sound features added lightning will flash across the silver screen, playing the part of both the natural phenomenon and the artificial one generated by man. The picture was made to illustrate the method of reproducing in the High Voltage Engineering Laboratory the terrific forces of lightning in order to study its effects and safeguard life and property.

Two small boilers, each holding less than eight gallons of water, have been found sufficient to drive a 133-passenger train over a German roadbed at a 68-mile clip. A report from the U. S. Department of Commerce indicates that the reason for this lies in the enormous pressure generated in these miniature boilers. It is 120 atmospheres, or approximately 1,700 pounds per square inch. In comparison, the working steam pressures on some of our largest American locomotives very rarely exceeds 250 pounds, while safety valves are usually adjusted to release the load on a boiler at around 205 pounds per square inch. The steam is delivered to a two-cylinder, piston-type engine turning at a rate of nearly 2,000 revolutions a minute. The new German train is streamlined and of light weight. It is expected that steam-driven trains of this type will eventually compete with the now popular diesel-driven types.

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SCIENCE NEWS

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GRANITE FROM SANDSTONE AND SHALE

ROCKS that were originally sandstones, limestones and slates have been found mysteriously changed by nature into granite. This is a most surprising phenomenon, since geologists heretofore have classed granite as a type of igneous rock that developed from a molten mass of material formed at considerable distances below the earth's surface.

Dr. G. H. Anderson, research geologist of the California Institute of Technology, made this discovery in the Inyo Mountains of California, during a study of the rock material composing the core of the range.

Batholiths, essentially masses of igneous rock, are common to almost every mountain range and invariably are composed of granitic rock. Rising from the depths of the earth, the molten batholithic material engulfs and melts rocks in its path, but solidifies before reaching the surface. Other dynamic forces produce shears or faulting in the crust and eventually uplift a tremendous rock mass, forming the mountain with the batholith as its core.

In the Inyo Mountains, during pre-Cambrian time, over 500,000,000 years ago, sedimentary rocks were being deposited in a sea that occupied the present position of the range. Since the recession of the sea and the present development of the mountains, certain chemical substances in solution, emanating from a batholith in the earth's interior, caused alterations and replacements in the sediments, making them virtually indistinguishable from a true granite.

Some of the striking features upon which Dr. Anderson based his conclusions are the preservation of the apparent bedding of the original sediments, the sedimentary relics found in the transposed granite, and the gradation of remnant sedimentary material into the granite. Numerous chemical analyses of different samples of the granite combined with petrographic studies substantiated Dr. Anderson's discovery.

GOVERNMENT SURVEY AS PART OF THE EMPLOYMENT PROGRAM

THE tall steel towers now conspicuous on the landscape in many parts of the United States are units in a great network of such towers that will eventually cover the whole United States so closely that no point will be more than twelve and a half miles from such a station.

They are being used by the U. S. Coast and Geodetic Survey in making control surveys of the land. The primary purpose of the present plan is to give work to unemployed men, but the more ultimate aim is an exact knowledge of the lay of the land that will determine boundaries of private properties and political units with more certainty, preventing much costly litigation.

The towers are temporary structures. Although they may be 100 feet or more high, they are put up in only about three hours, and may be dismantled with equal speed and facility to move on to the next point where a triangulation station is needed.

Each is a double structure, the outer portion, supporting the observer's platform and a light, being without any contact with the inner tower on which the surveying instrument is placed. Thus the precise instrument is kept from any jarring with the movements of the observer.

The triangulation method of surveying is based upon the scientific principle that if one side of a triangle and its angles are known, the remaining sides can be computed mathematically. The tall towers are erected to enable the surveyors to make observations from one corner of a triangle to another, possibly 25 miles away. Where mountains or hilltops are available, these are used to cut down the height necessary for the tower, but in flat wooded land it is sometimes necessary to build them as much as 120 feet tall.

Each tower is equipped at its top with a light which is observed at other towers. The angles of the triangle marked off by the lights are measured precisely with a scientific instrument, the theodolite.

By this system, it is possible to measure the distance between two points so accurately that the error will probably be less than five feet in a distance of one hundred miles.

ALTITUDE FLYING AND IMPROVED WEATHER FORECASTING

CLIMBING to altitudes of over three miles, Army, Navy and commercial pilots for the U. S. Weather Bureau will now carry instruments aloft with them each day from twenty different airports, on vertical hops to record conditions in the higher air and give weather experts increased data on which to base their forecasts.

For the past two or three years commercial pilots have been making observations daily above the clouds, but not until the beginning of July, mass analyses of the upper air have not been conducted on a large scale.

Each observation pilot has attached to the wing of his plane a meteorograph, an instrument which automatically records humidity, temperature and pressure. These are the three R's in the science of predicting the waves, eddies and cross currents of that turbulent sea, the atmosphere. In addition, the pilot notes the altitudes of the top and bottom of cloud banks, the positions and altitudes of rainstorms which pelt down into dry strata of air and never reach the ground, and local disturbances such as thunderstorms or dust clouds. Pilot balloons sent up from the ground and watched through precise telescopic instruments furnish a method of finding accurately the direction and speed of different layers of air as the small, gas-filled spheres rise through them.

The use of airplanes furnishes a striking contrast to the methods of thirty years ago; the principle, however, is the same. In the days when flying was still a matter for conjecture as to its possibility, large box kites were used. These were about eight feet long and rose to altitudes of 10,000 to 18,000 feet, carrying instruments with them. They were primitive from the viewpoint of

tific precision, and dangerous when they broke loose and trailed their piano-wire kite strings along the ground.

Of the many services, regional and national, which the U. S. Weather Bureau accomplishes, Dr. C. C. Clark, acting chief, considers that the use of extensive airplane observations at high altitudes will be most important to commercial and military air travel. Pilots will know more definitely what lies ahead; they will know whether they can climb to a desired altitude without encountering a snow squall or head wind, or whether danger lies before them.

A SIDEROSTAT TELESCOPE

WHEN Gustavus Wynne Cook, banker, manufacturer and amateur astronomer of Philadelphia, wishes to observe the stars next winter from his private observatory at Wynnewood, he will not have to do it from a cold observatory, where the temperature inside and out must be the same.

From a steam-heated room he will use a telescope projecting horizontally in through one wall, and by means of remote electrical controls he will operate a 25-inch diameter mirror outside which will reflect the star light into the 15-inch lens of the telescope. A series of dials, electrically connected to the mirror, will enable him to tell where it points, and to set it accurately to any astronomical body within reach. An accurately adjusted electric motor, operating in a manner similar to the electric clocks that one attaches to the lighting circuit, will keep the mirror moving steadily. Thus it will compensate for the earth's turning, and will remain pointed to the star.

This is called a siderostat telescope, and it is believed to be the first of its kind in the United States. It is now reaching completion in the telescope works of J. W. Fecker, in Pittsburgh, and it will be installed within the next few weeks. Already Mr. Cook has several other instruments, including two special telescopes for the study of the sun and a 28½-inch reflecting telescope. This instrument is now in regular use in cooperation with the Sproul Observatory of Swarthmore College. It is being used with a spectroscope in a research program measuring the speeds at which the stars are moving towards or away from the solar system.

FAST-SWIMMING SEA ANIMALS

IF marine engineers really wanted to increase the speed of great ocean liners they would put the ship's propeller in the bow and make it act as a "puller" instead of a "pusher" as now used. This is the verdict of Dr. Heinz Judis, after a study of the methods of movement in fast-swimming sea animals like the penguins, dolphins, seals and sharks.

All these animals, which gain remarkable speed in spite of comparatively small effort, have two sets of "propellers" which are the fins in front and rear. But in fast swimming only the forward fins are employed for straight-ahead motion. The tail fin serves mainly for steering.

A ship produces a bow wave, a resonance wave, and a system of stern waves. At high speeds these complicated wave systems constitute the major part of the total resistance. Every propeller, and so also a penguin's wings, according to Dr. Judis, produces a system of waves. But when a penguin is swimming fast, the waves produced by the wings cancel the bow waves so that the animal saves nearly the whole of this resistance.

Towing tests on a dead penguin made at the Berlin Institute of Shipbuilding Research showed that the resistance decreased the moment that the water began to flow over the shoulders of the animal, and the bow wave then almost disappeared.

Dr. Judis equipped a boat with fins and a mechanism by which the combined flapping and feathering motion of a penguin's wings could be simulated. The wooden fins were of necessity stiff, whereas they should have been flexible. But despite this defect the results exceeded expectations. The boat propelled by two men made 2.8 to 3.7 miles per hour.

For comparison, the boat was also equipped with paddles, and was driven in each case at 6.2 miles per hour. Photographs showed that with the paddles strong bow waves were developed, but with the fins they were almost entirely absent.

ACID SEEPAGE FROM COAL MINES

LIKE plugging rat-holes to prevent disease contagion, it has been found necessary to stop up the entrance to over 1,200 abandoned West Virginia coal mines to prevent the formation of dangerous amounts of sulphuric acid in seepage water far underground.

A recent report to the editors of *The Engineering News Record* states that the concentration of sulphuric acid in the small streams and rivers of that region has been found sufficiently great to menace the public health. The task of plugging over 4,200 mine openings with heavy walls of stone and concrete has been undertaken as a CWA project under the direction of the U. S. Public Health Service.

Engineers of the U. S. Bureau of Mines estimate that from one to three years will be required to bring river water back to normal conditions, although favorable results have been observed from more than 1,200 mine entrances already closed.

Chemically the reaction that forms sulphuric acid in the depths of the earth is quite simple. In most coal regions iron sulphide, commonly known as pyrites, is present in small quantities. This reacts with the oxygen in the air to form sulphuric acid in the seepage water. By hermetically sealing up all possible entrances the reaction is lessened.

Engineers investigated the presence of this powerful acid in river water when a high mortality of fishes in the locality was first noticed. Later it was found that the acid was in some cases sufficiently concentrated to corrode iron boats and metal parts of canal locks near the source of seepage.

DISTEMPER AND INFLUENZA

POSSIBILITY that the virus causing dog distemper may provide man with a new weapon against influenza appears in a report of Drs. Adolph Eichhorn and Norman J. Pyle, veterinarians of Pearl River, New York, to the American Medical Association.

Drs. Eichhorn and Pyle found that the virus of human influenza apparently makes ferrets immune to attacks of dog distemper. Their investigations suggest that the two diseases, influenza in man and distemper in dogs, are related somewhat as smallpox in man is related to the bovine disease, cowpox.

Vaccination of human beings against smallpox depends on this relation. Smallpox vaccine is made from the virus of cowpox. If distemper and influenza prove actually to be related, scientists may be able to develop from the distemper virus a vaccine that will protect against influenza. So far no successful vaccine against influenza has been developed. Drs. Eichhorn and Pyle are now working on experiments to determine the possibilities of producing such a vaccine from the dog distemper virus.

Their work so far has been confined to ferrets and their discovery that influenza protects these animals against distemper was made accidentally. They had been using ferrets for routine tests of canine distemper virus, when they decided to study an influenza virus obtained from human cases of the disease by the British investigators, Wilson Smith, C. H. Andrews and P. P. Laidlaw. The virus produced influenza in ferrets, just as the British investigators had reported. It was, however, a surprise to find that the ferrets after recovering from an attack of influenza were immune to the distemper virus given for the routine tests of the latter.

Claims have been made before now that influenza and distemper are related; but so far no definite proof has been presented of the identity or relationship of these viruses. Drs. Eichhorn and Pyle believe that their experiments strongly point to such a relationship.

THE CAUSE OF ALLERGIC DISORDERS

A NEW theory of the cause of hay fever and similar allergic disorders was presented to the recent meeting of the American Medical Association by Dr. Reuben L. Kahn, of the University of Michigan. As Dr. Kahn sees it, these diseases are not due to a special sensitiveness of certain persons to the pollens or other offending substances. Instead it is due to overactivity of the defensive forces of these persons' bodies which protect them against invading disease germs.

It may be that in some persons these defensive forces become over-zealous about guarding against foreign invaders of a protein nature. They may fail to distinguish between harmful invaders like the pneumonia germ and innocuous substances like plant pollens and horse dander.

The body tissues respond to invaders by a complicated process, the first step in which is an anchoring of the invader at the point of entry. The second step in the process is an attempt to kill the enemy on the spot; this is a process of inflammation which may be very uncomfortable for the individual being protected.

The sneezing, nose-running and eye-watering of the hay fever sufferer may be such an inflammatory process. The consequent discomfort may be a necessary evil in overcoming a cold or similar infection of nose or throat, but it is an unnecessary evil in the case of hay fever.

The fact that many persons inhale the same plant pollens without ill effect seems to show that in themselves they are not harmful and that the symptoms they sometimes cause result from a mistake by the tissue guardians of the body.

The mistake, Dr. Kahn suggests, is the result of modern living conditions. Enclosed homes and large group contacts in the office, factory, classroom and theater may lead to over-stimulation, particularly of the defensive forces in the nose and throat, by constant bombardment with disease germs.

ITEMS

BATHING rheumatic joints of hands, feet, wrists and ankles in hot paraffin is a valuable means of treating these conditions in arthritic patients, Dr. Bernard Langdon Wyatt, of Tucson, Arizona, has reported to the American Congress of Physical Therapy. The paraffin bath enables the physician to apply greater heat to the painful, crippled joints than is possible with solutions, packs, foments, oils or radiant heat, Dr. Wyatt explained. The reason seems to be because a tiny insulating space forms between the patient's skin and the inner layer of the paraffin coating which he gets over his hands or feet when the paraffin bath is used according to Dr. Wyatt's method. The insulating space helps the patient to endure very high temperatures. The high temperature causes an increased supply of blood to the affected part which relieves the pain and stiffness and enables the patient to move his joints more freely.

COD-LIVER oil, best known for its ability to prevent or cure rickets in children and to hasten their slow convalescence from infectious diseases, has found a new use as a dressing for wounds. This new use for the familiar oil was discovered by Professor Löhr as a result of three years of experimenting with thousands of cases at a hospital in Magdeburg. Combined with other fats to make a semi-solid ointment, cod-liver oil speeds up the healing of wounds, apparently giving just that fillip that makes all the difference between sluggish and quick recovery. Whether or not the speedier healing is a result of the high concentration of vitamins A and D in the oil Professor Löhr does not know, though he considers it a possibility. He says the new ointment is no panacea and should not be used indiscriminately. He uses it in selected cases, pasting on to wounds, sores and ulcers a layer so thick that the overlying dressings do not come into contact with the raw, tender surfaces of the wound, thus eliminating pain when the dressings are changed.

POSSIBLE existence of another hitherto unknown vitamin, with ability to prevent hemorrhage, is seen in experiments just reported by H. Dam of the Biochemical Institute of the University of Copenhagen. Chicks fed an experimental diet developed a disease very much like scurvy, the chief feature being extensive internal hemorrhages, Mr. Dam reported in a note to the British scientific journal, *Nature*. Large doses of anti-scurvy vitamin C in the form of lemon juice and ascorbic acid did not have any effect on the disease. But a diet consisting entirely of cereals or seeds plus salts prevented the occurrence of the hemorrhages. "The cause of the disease," concluded Mr. Dam, "must therefore be a deficiency in an antihemorrhagic factor different from vitamin C and occurring in cereals and seeds."

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SCIENCE NEWS

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SCIENTIFIC EQUIPMENT OF THE STRATOSPHERE BALLOON

WITH a last minute check-up of instruments all but complete on July 13 and only favorable weather conditions needed for the departure of the stratosphere balloon *Explorer*, the intricate problems which face Captain Albert W. Stevens and Major William E. Kepner on their forthcoming ascension become clear.

Before the appearance of this note the two men will probably have taken off in a floating laboratory hopeful of conducting enough scientific tests to keep a university staff busy for months, and at the same time have a world's altitude record to think about. With a ton of instruments as their companions on the flight, Stevens and Kepner will be part of what might be called a scientific Christmas tree, for apparatus will cover the inside and outside of their gondola, hang by long ropes from beneath the balloon and be attached in every conceivable place.

Each day at the Stratocamp of the National Geographic Society-Army Air Corps expedition new apparatus has arrived for installation on the balloon with the hope of solving different scientific riddles. Now the situation has almost reached the state where the adventurers are beginning to wonder if they can operate all the apparatus.

Thirteen major objectives have already been outlined for the flight not including the sought-after altitude record. They are:

1. Collection of stratosphere air samples at many levels.
2. Taking of complete temperature and barometric data from the ground to the highest point attained.
3. Aerial photographs to check curvature of the earth, also the customary barometric system of measuring altitude.
4. Cosmic ray data with both electroscopes and Geiger-Muller counters.
5. Wind velocity measurements.
6. Check of solar radiation intensity.
7. Photographs of the sun's spectrum.
8. Determination of ratio between sky brightness and sun brightness; color of sky at high altitudes.
9. Tests on actinic effect of light.
10. Effects of altitude on radio transmission.
11. Effect of radiation, both solar and cosmic, on fruit flies as check on possible mutations.
12. Same for spores.
13. Technical problems of balloon navigation.

While much of the apparatus is automatic, it can be seen that Captain Stevens and Major Kepner will not be idle during their hours in the air.

TEMPERATURE OF THE STRATOSPHERE

EXPLORING the stratosphere by means of explosions set off on the earth's surface is one of the new methods of gaining information about this region without leaving the ground. The experiments are described by Dr. Kurt Wolcken, of the University of Göttingen, in *Forschungen und Fortschritte*.

It has often been observed, Dr. Wolcken writes, that a great explosion can only be heard within a radius of 80 to 100 miles. Beyond this limit there is a ring of silence, and then another zone, where the sound can again be heard. There is a skip zone for the sound just as there is for short radio waves.

Two theories have been proposed to explain the phenomenon. One is that the effect is due to the increase in wind velocity which occurs with the height. Sound is more often heard to the east in winter and to the west in summer, and other correlations with wind velocity and direction have been noted.

Another theory is that the effect is due to a rise in temperature in the upper stratosphere, but there is no experimental evidence in its support. Sounding balloons have seldom risen above 20 miles (the record is 22 miles). They have shown that the temperature diminishes to about minus 67 degrees Fahrenheit at a height of 8 miles, and then remains sensibly constant up to the greatest heights reached. Moreover, it is difficult to see why there should be a rise in temperature at greater heights, unless the upper layers of the stratosphere are for some reason more strongly heated by the sun's rays than the lower layers.

To test this temperature theory, experiments were made in the polar regions during the polar night 1932-33. Twenty-eight explosions were set off, using 13,500 pounds of explosives. The return sound was heard despite the fact that the sun's rays had not reached to air at a height of 65 miles for six weeks. The delay in the sound was about the same as in middle Europe, so that the sound must again have reached this height before returning earthward.

The conclusion drawn was that if there is a rise in temperature in the upper stratosphere, it can not be due to the sun's rays. It might be due to the cosmic rays or to the ozone layer.

DESTRUCTION OF TREES BY THE DUTCH ELM DISEASE

FINE old elm trees, of which the eastern states are so justly proud, are now succumbing to a renewed attack of the Dutch elm disease at the staggering rate of 200 a day.

The ravages of this affliction have become so serious that Congress appropriated $150,000 now being used for the work of checking the blight. Already the death knell has rung for 3,027 shade trees in the region around New York.

The greatest loss has been suffered by New Jersey, where the mortality of elms to date is 2,456. And each day new cases of the disease are discovered. The only check which has been found is to chop down and burn the trees the moment tests have shown them to be infected.

The Dutch elm disease first appeared in 1920 in Holland. It waged a destructive war against European elms and then proceeded to cross the ocean in the holds of

ships carrying elm logs for the furnitude industry. It made its first appearance in a flank attack in Ohio three years ago, but not seriously as only nine elms were felled and immediate action checked further damage.

In the last few months, however, it has stabbed the heart of the elm region around the port of New York. A small bark beetle, *Scolytus*, carries the infection in the form of a fungus known as *Graphium ulmi* which attacks the smaller twigs and withers whole branches of the tree.

None of our native elms seems to be immune, although an oriental variety is not infected. This tree, imported from Asia, can nevertheless be a harborer of the disease and should also be destroyed if it is found to be bearing the fungus.

When queried as to whether this epidemic will have the terrible effects of the blight which years ago stilled the whistles of so many chestnut vendors, the investigators of the U. S. Department of Agriculture state that it is equally serious from its present aspect. Whether a wholesale slaughter of elms will take place in the future can not yet be foretold.

CORN AND THE CHINCH-BUG

COUNT round one in favor of King Corn in his battle against Kid Chinch-Bug. With the able seconding of farmers and scientists, the most vicious onslaught of the boring-in enemy of the principal grain crop of the country has been stopped. The fight now enters the second round, with no predictions good for much, though the odds seem to favor corn again.

When the oats crop, the chinch-bug's first training-table, began to dry up in the early summer heat, the insects started their regular invasion of the cornfields. Here they were met by trenches, barriers of creosote oil, and pit-traps in which they could be burned or crushed. In general, throughout the whole corn belt of the Mid-west, alert farmers supplied with ammunition by state and federal authorities kept their fields free of the crawling hordes. Practically all the chinch-bugs that tried to get into the corn were blocked out, and subsequently destroyed.

Now the crawling stage of the first brood of the bugs has ended. The survivors that did not attempt direct assault on the corn have grown their wings and flown over the barriers. They are at present feeding in reduced numbers in the corn, but not doing it appreciable harm.

Their real threat will come after they have bred, for their offspring are the insects that will survive the winter, lurking in stubble and in the weeds and grasses of the fence rows, to be ready to make a fresh attack next year.

This renewed threat will be met by cleaning up the fields, plowing the stubble under, and where practicable by burning the growth along the fence rows.

Principally, however, the question whether 1935 will be another bad chinch-bug year will have to depend on the winter weather. January and February may be the Mid-western farmer's best friends, as they were once Russia's best generals, when Napoleon retreated from Moscow. But if the winter months turn out to be too mild, the chinch-bug war will have to be renewed next summer.

Chinch-bugs have spread over territory far to the north of their usual range, due to a succession of hot, dry summers in the past few years. In Iowa, for example, they normally occur in troublesome numbers only in the extreme southwestern corner of the state and to some extent across the southern tier of counties. At present they are rated as "bad" well up into central Iowa, as far north as Des Moines, and reported "present" clear up into the northeastern section, though not reaching to the extreme northeastern corner of the state.

EPILEPSY IN AN IDENTICAL TWIN

A PERSONALITY study of identical twins, only one of whom suffers from epilepsy, throws new light on the hereditary constitution of those subject to this disease. The case of these sisters, young girls strikingly similar in appearance, one of whom has been stunted mentally and in personality by the disease, has been reported to the American Neurological Association by Dr. Walter Freeman, of the George Washington University.

Physically, one of the girls might be the mirror image of the other, except that the epileptic patient is about an inch and a quarter shorter than her sister. They are similar in color of eyes and hair, skin texture, shape of ears and hands, tone of voice, and even in a peculiar characteristic fluttering of the eyelids and marked readiness to burst into tears with slight provocation. They have also followed very similar careers, both starting in the same occupation. Both are married—and to the same type of individual.

But the personalities and mental abilities show significant differences. Since they are identical twins with exactly the same hereditary make-up, scientists may be justified in assuming that the healthy sister presents a picture of what the other girl might have been had she not developed epilepsy. And their similarities in temperament throw light on what are the fundamental constitutional factors—the X-factor—present in the individual who is subject to epilepsy.

Both girls are intensely religious. As children they played at being hermits, and spent hours in church praying. Both are deeply affected by beauty in art and music. And both are decidedly self-centered and egotistical.

Mental tests show the healthy sister to be ten points ahead of her twin in intelligence quotient; she is alert and capable while the patient is rather dull. The healthy girl has also spent her spare time in study and has qualified for a superior position. The patient is meticulous about following instructions in detail, but is content to spend her spare time in light reading or desultory conversation.

The outstanding feature in the personality of both girls is self-centeredness. This and the supersensitiveness of both girls may be underlying characteristics of the epilepsy-prone person, according to Dr. Freeman. The strong religious tendency might also be characteristic of the epileptic personality, as many have previously held, or it might be a result of the early training of the girls. Other character traits of the epileptic, such as the dullness of mind, explosiveness of temper, performance by

rote of instructions, which have previously been thought a part of the epileptic personality, are really effects either of the original injury to the brain which caused the epilepsy or of the repeated "insults" to the brain from the epileptic attacks.

PLANTS THAT DEFY DROUGHT IN A DESERT

DROUGHT and heat mean nothing to a few species of extra tough plants that grow in a unique desert composed of drifting dunes of pure gypsum crystals.

Two hundred seventy square miles of these drifting gypsum crystals constitute the area known as the White Sands of southern New Mexico. These dunes are so white that it is almost impossible to avoid the impression that they are fifty-foot snow drifts. This illusion tends to weaken, however, when the thermometer registers 100 in the shade that isn't there. Studies of the adjustments to these peculiar conditions are now being carried on by Professor Fred W. Emerson, of New Mexico Normal University.

The gray or brownish dunes of impure quartz sand found in arid lands and along the shores of lakes or seas make hard conditions for the growth of plants, but these drifting piles of gypsum sand add new difficulties to plant life. Chemical tests show that there is not more than perhaps 2 per cent. of impurities in the gypsum, thus introducing difficulties in absorbing sufficient amounts of nitrates and other essential soil nutrients.

As in all drifting sand, there are only a few species of plants that are able to grow upward fast enough to keep from being covered by the advancing dunes. In the White Sands there are only six species that commonly succeed in the moving sand. They are a cottonwood, rabbit brush, aromatic sumac, a shrubbery pennyroyal, a yucca and that peculiar gymnosperm, *Ephedra*.

Some of the individuals of species that usually grow to be only shoulder high under ordinary conditions grow forty or fifty feet upward through the dunes. All of these develop numerous roots under the sand.

ITEMS

THAT the health of the country is not so good this year as it was last is shown by a study of the figures of life insurance companies and of the U. S. Census Bureau. 1933 was an all time record year for good health and officials of the Metropolitan Life Insurance Company consider 1934 "by no means an unsatisfactory year from the standpoint of public health." Yet up to the end of May the cumulative mortality rate was 4.4 per cent. higher than for the same months of 1933, and, according to the U. S. Census Bureau's records for 86 leading cities, the death rate up to the week ending June 2 was 5.1 per cent. above that for the corresponding part of last year. Deaths from measles and whooping cough were twice the number recorded last year. There have also been increases in the death rates for cancer, heart disease, diabetes, cerebral hemorrhage, chronic kidney disease, pneumonia, accidents and automobile accidents.

ENCKE'S COMET, most frequently returning of these visitors from space, has been picked up for the first time on its present visit to the sun's neighborhood. The discovery was made by Dr. Hamilton M. Jeffers, of Lick Observatory. One of the most reliable of all comets as well as shortest in period, Encke's comet has been observed to make its return every three and a third years for more than a century. It is now very faint and visible only through the largest telescopes. It is a diffuse spot of light without a tail. It was seen at just about the place in the heavens that computations made months ago indicated that it would appear. Details of the rediscovery of this comet have been relayed through Harvard College Observatory to astronomers throughout the world.

WHILE Dr. Sven Hedin, one of Sweden's best known scientific adventurers, is reported in the hands of Chinese bandits, other Swedish explorers are making ready for expeditions to distant fields. Crown Prince Adolf, who ranks as one of Sweden's leading archeologists, will set out for Bagdad in the autumn to take part in excavations in Mesopotamia. An ethnologist of the Swedish National Museum, Henry Wassen, is making ready to sail for South America, to continue studying the Chaco Indians of Colombia, a work begun by the late Erland Nordenskiold. The geologist Professor Hans Ahlmann will join with Professor Sverdrup to observe glaciers in the interior of Spitzbergen. And four Swedish zoologists are setting out for Brittany, to continue experiments with the eggs of sea-urchins, in research expected to throw valuable light on phases of evolution. Among Sweden's scientific representatives already abroad is Dr. Carl T. Hammarlund, who is studying potato plants in the mountains of Chile and Peru, in the hope of discovering a potato more resistant to frost and insects than potatoes now grown in Sweden. In India, Dr. Walter Kaudern is making biological studies and seeking rare orchids, with the mission of bringing back their seeds for the King of England.

ACTING as an overcoat not only for the tree but also for any insect pests that may be harbored beneath it, the thick bark of western pine trees protects both themselves and the pests, according to Dr. F. P. Keen, of the U. S. Department of Agriculture. Temperatures from 15 to 35 degrees below zero are not uncommon during the winter in regions where this pine grows, but the insects are not killed. On comparing the temperature beneath the bark with the air temperature, one half-inch of bark was observed to cause a difference of 8 degrees, a one-inch bark a difference of 18 to 21 degrees, and a two-inch bark a difference of 29 degrees. With the internal temperature that much higher than the air temperature the bark-beetle mortality from the cold, though increasing with the decrease in temperature, is especially severe below 17 degrees; but this internal temperature is not frequently reached in the case of deeply hibernating beetles. The insect mortality, Dr. Keen says, is 55 per cent. at 11 degrees, 64 per cent. at 14 degrees and 73 per cent. at 17 degrees below zero.

SCIENCE NEWS

Science Service, Washington, D. C.

PAPERS PRESENTED AT THE INTERNATIONAL SPECTROSCOPY CONFERENCE AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

PROFESSOR J. STUART FOSTER, of McGill University, and Professor Jacob Cholak, of the University of Cincinnati, in a report made before the Second International Spectroscopy Conference held at the Massachusetts Institute of Technology, pointed out that lead may be detected in the human body in a tenth the usual time for such a test by means of the spectroscope. The spectroscope is a fine optical instrument for examining matter by studying the light given off when electrons are hurled into the atoms of which it is composed. While qualitative determination has been possible for some time, exact qualitative measurement has been exceptional without the use of the spectroscope. Both investigators also pointed out that chemical analysis heretofore used requires anywhere from 10 to 14 days while the spectroscopic analysis is possible in a period varying from 24 to 48 hours. This method also requires less tissue for the test. Professor Foster explained that the tests are made by a comparison of the intensity of the lead spectra with that of magnesium in the same sample being tested, in this case, an amount of spinal fluid. Using known and concentrations to add to the spinal fluid and establishing a relation between the above ratio and the lead concentration, it is possible to detect one hundred millionth gram of lead per cubic centimeter. Professor Foster hopes to apply this method to the study of lead as a possible cause of multiple sclerosis.

FORECASTING death by means of spectroscopic investigation of the blood of patients was reported by P. and P. Lecomte du Noüy, of the Pasteur Institute, who did not attend, but communicated their report to Professor George R. Harrison, of the Massachusetts Institute of Technology, chairman of the conference. Analyzing over 1,000 samples of the blood of men, horses and sheep, it was found that curves plotted by a spectroscopic examination of the serum and white plasma of the blood show remarkable constancy, "so great that they can be exactly superimposed on each other." When departures from this general curve are noted, it is stated, it can be safely interpreted as an indication of pathological disturbances. Such alterations are rare and seem to correspond to fatal cases. "Alterations in the curves," according to the report, "must correspond to very deep chemical modifications affecting the chromophoric (color) elements which belong to very stable chemical groups. A man's death, which followed in 24 hours, was predicted. He was partly paralyzed, owing to a malignant tumor of the spine, with metastases in the lower jaw, and urinary infection. He was expected to live, however, for many months.

CURIOUS facts about the germination of lettuce seed were reported by Lewis H. Flint, of the Bureau of Plant Industry, U. S. Department of Agriculture. Comparing the sensitivity to light of the lettuce seed to that of the average photographic film, he said that red, yellow or orange light accelerates the germination process while a blue or green light tends to inhibit this. Only four seconds' exposure to light is necessary to start germination, but light is essential to the process.

A NEW kind of porphyrin, the basic substance in the red coloring matter of blood and also of chlorophyll, the green coloring matter of plants, is leading to the conclusion that plants and animals may have sprung from the same ancestor in the beginning of evolution. Dr. Calvin R. Coulter, of Columbia University, described his investigations of porphyrin with a spectroscope. Porphyrin was extracted from cytochrome, a substance found in nearly every living thing dependent on oxygen. Combining porphyrin with various metals, Dr. Coulter was able to produce light spectra which he could analyze in his spectroscope. By reducing the temperature to that of liquid air, however, over 300 degrees below zero Fahrenheit, more detailed and clearer spectra were obtained. Dr. Coulter pointed out that the spectroscope is now useful for studying living matter almost as easily as it has previously been possible to study inanimate things like metals, gases and liquids.

WHY do some bees turn into queen bees and others into workers? The reason may be that the body of the queen bee contains the element manganese and no sodium while the worker bees have plenty of sodium. This is the report of Professor Ramon Ricard, of the Faculté Catholique des Sciences, France. Dr. Ricard used the spectroscope to analyze the light given off by different kinds of bees when their bodies are ignited and so discovered the chemical elements in their composition. An interesting aspect of his work lies in its similarity to that carried on at the Johns Hopkins University where it was found that the removal of manganese from the diet of mother rats resulted in a decrease in the interest shown by the rats for their young.

NEW dyes, resistant to fading by light and washing, are being developed by studies of the colors which they absorb when light is passed through them, according to Professor Wallace R. Brode, of the Ohio State University. By analyzing the light absorption of dyes, Professor Brode is investigating the causes which make them decompose. He believes that it is a photo-chemical reaction, and he hopes to be able to predict from the absorption spectrum of a dye its exact structure. In that case we should be able to synthesize dyes and make exactly what we wish.

L. G. S. BROOKER, of the Eastman Kodak Co., described the technical methods of creating photographic plates sensitive to all colors of the visible spectrum and parts of the infra-red region also. In an illustrated lecture he

showed the difference in the final picture obtained with color-sensitized plates and the kind now in ordinary use.

INVESTIGATIONS OF CANCER

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WITHIN seemingly normal cells of human bodies, there is always a virus capable of causing cancer. Whether or not the disease develops depends upon whether a physiological "trigger," in the form of mechanical or chemical irritation, sets free the virus. This new theory of cancer with evidence for its support is presented by Dr. C. H. Andrewes, of Great Britain's Medical Research Council.

Dr. Andrewes's report to the Royal College of Surgeons appearing in the *Lancet* is commended by the editor as "by far the most comprehensive survey" of the subject yet presented.

When irritants initiate malignancy, Dr. Andrewes believes, no virus enters the body. It has always been there, dormant, pending the trigger mechanism which sets off the malignant process. Such mechanical balance would explain the gradations from benignancy to extreme malignancy which are seen in tumors.

The development of cancer is seen as somewhat analogous to the formation of fever blisters. A mere rise in body temperature, such as caused by a fever, is enough to cause fever blisters in about every other person so afflicted. The herpes simplex virus seems to be liberated by the heat and causes the face eruption.

Dr. Andrewes's theory, according to the editorial, confirms the fact that cancer is not infectious in the conventional sense. In other words, although caused by a filtrable virus it is not infectious like infantile paralysis, for example, which is also caused by a filtrable virus.

Many cancer students have thought that mammalian cancers are an apparently different class of tumors from the filtrable fowl tumors, but Dr. Andrewes does not agree. He thinks the two kinds are really alike. The only way in which filtrable tumors of birds differ from cancers of men and other mammals lies in the fact that the causative agent of the fowl tumors can be demonstrated apart from the cells it normally inhabits, he concluded from his investigations.

The causative agents of cancer have properties so like those of the known viruses that excluding them from the virus group is unjustified, in Dr. Andrewes's opinion. The natural history of other viruses readily explains the production of tumor growth phenomena, he stated. Many viruses multiply within the cells of the body and once they have got into these cells they can not be neutralized by external antibodies.

A POSSIBLE NEGATIVE PROTON

To explain why the central nucleus of many kinds of atoms sometimes spins one way and sometimes the other, a new kind of entity within the atom has been postulated, tentatively called a negative proton.

The negative proton is still unfound but physicists all over the world are on the lookout for it. It would have the same mass as the cores of hydrogen atoms—the protons—but would have a negative charge of electricity upon it instead of the customary positive charge.

The existence of such a particle is suggested by Dr. S. Tolansky, of the Imperial College of Science, London, in a report to *Nature*.

Only a few weeks ago Professor George Gamow, from the Polytechnical Institute, Leningrad, U. S. S. R., suggested to members of the American Physical Society, meeting in Ann Arbor, that a negative proton would be most helpful in explaining many of the difficulties regarding the stability of certain atoms like beryllium, which are now made to undergo artificial radioactivity.

The original prediction of the negative proton can be credited to Dr. Carl Anderson, of the California Institute of Technology, who in March, 1933, suggested that the emission of positrons from an atom struck by high-energy radiation might be due to the break-up of a neutron by the impact. In the collision a positron would come off and a negative proton should remain within the atom. If an electron came off when a neutron broke up an ordinary positively-charged proton should remain inside.

Basically the negative proton enters atomic physics because there is a growing suspicion that the neutron may be composed of two different arrangements of particles which are externally indistinguishable. The neutron is the so-called non-electrical particle because whatever charges it contains are so closely bound that there is no observable external field.

It seems now as though a neutron may be composed of a close union of a proton and an electron whose charges equalize one another; or it may be composed of a negative proton and a positive electron where again the opposite charges neutralize each other. Both these neutrons would have the same weight and the same lack of external charge. They would be hard to tell apart unless they were split apart, but after such a break-up the original composition would, of course, no longer exist.

DINOSAUR REMAINS IN WYOMING

(Copyright, 1934, by Science Service)

EIGHT gigantic prehistoric animals, dinosaurs that roamed lakes and swamps of 125,000,000 years ago, have been discovered by Dr. Barnum Brown, curator of fossil reptiles of the American Museum of Natural History, New York, some 25 miles east of Greybull, Wyoming, in the foothills of the Big Horn Mountains. Enough bones have been uncovered to cause Dr. Brown to feel that "we have stumbled upon one of the greatest fossil mines in the paleontological history of America."

At present the dinosaur remains are simply a large pile of loose bones, but when assembled eventually as museum exhibits their skeletons will probably show that the sauropod dinosaurs, believed to belong to a hitherto unknown species, ranged in size from 25 to 40 feet in length and from 10 to 14 feet in height. They were salamander-like creatures.

Dr. Brown, as head of the American Museum-Sinclair dinosaur expedition, has been excavating in the vicinity of Keyhole Canyon since the early part of June and the excavations are now producing dramatic and surprising results. For Dr. Brown had only expected to find two sauropods instead of eight.

"To date we have uncovered enough bones spread

over a seventy- by sixty-foot site,'' stated Dr. Brown, ''to feel satisfied that we have at least eight sauropod remains before us. Others may be buried under this layer of bone or near it. The bones are not articulated, hardly even associated, but they are so unusually well preserved that the task of reconstructing them will be quite easy. For one thing, they are entirely free from the iron and crystal deposits which frequently make the matter of cleaning and restoring fossil bones a herculean and almost impossible task. While I have nothing definite to base this statement on, I somehow feel that we have only scratched the surface yet and that we have stumbled upon one of the greatest fossil mines in the paleontological history of America. We have at least 50,000 pounds of fossil bones in sight and one of the things that worries us is to preserve them from the elements long enough to get them out of the ground and carted to Greybull, which includes a ten-mile journey over narrow and rough mountain trails.

Owing to the important nature of Dr. Brown's discovery, he has, for the time being, sidetracked previous plans to continue this summer his search for further fragments of the ''bantam dinosaur'' he discovered near Harlowton, Montana, last summer.

ITEMS

AN expedition of twelve scientific men mostly from eastern universities, and headed by Professor Leslie Spier, of Yale, have arrived in southern Oregon to study the picturesque Modoc Indians. Professor Spier is already known for his researches and published works on the Indians of this region. The Modocs are historically famous for their frequent conflicts with white immigrants in earlier decades, in which many atrocities were reported on both sides. After the Modocs ceded their territory, and moved to the Klamath reservation, they still were restive for their old homes, and their determined efforts to return there led to the Modoc War of 1872. Professor Spier's study of the manners and customs of this independent-minded people is to be sponsored by the Rockefeller Foundation, and is directly under the Laboratory of Anthropology at Santa Fé.

BEFORE engineers pour in water to create an artificial lake at the great Bonneville dam on the Columbia River, an archeologist will make the last attempt to explore the dry land for signs of prehistoric Indian life. Herbert W. Kreiger, of the Smithsonian Institution, Washington, D. C., has come West to make the search for Indian remains. The region is of particular interest in ancient American events because the Columbia River Valley was one of the natural highways along which migrating groups of people of Asiatic origin would presumably have pushed their way down into the United States.

ZINC is a necessary part of animal diet Drs. Gabriel Bertrand and R. C. Bhattacherjee have reported to the Paris Academy of Sciences. Their conclusion is based on studies of mice. Baby mice as soon as they could be separated from their mothers were divided into two groups. To one group was given food entirely free from zinc, to the other the same food to which a minute quantity of zinc had been added, one part in fifty thousand. The first group did not thrive from the start. They became thin, emaciated, lost their hair, and died from various ailments after an average life of 17 days. The second group survived for an average life of 64 days. Post-mortem examinations of this group showed that about a fifth of the zinc administered had been incorporated in the body tissues. All the mice had the proper amount of vitamins. But without zinc they quickly died.

INSECTS, like other classes of animals, are fatally affected by prolonged exposure to temperatures over 104 degrees, and the Mediterranean fruit-fly, erstwhile menace to Florida agriculture, is no exception, according to Drs. Hugh H. Darby and E. M. Kapp, formerly entomologists with the U. S. Department of Agriculture. All stages of the fly are adversely affected by that temperature, they say, with adults and young pupae being all killed in less than seven hours and the old pupae and larvae in 13 and 17 hours, respectively. The other extreme is also fatal, the young pupae dying in 15 days at 40 degrees and in about 30 days at 50 degrees. The temperature of 104 degrees is critical for many types of animals with the lethal effect of the heat being more pronounced as the temperature advances. At 112 degrees, they found that no larvae were still alive in mango pulp that had been exposed to that temperature for four hours.

IRREGULARITIES on a polished metal surface are now transformed into sound by a needle and amplifying apparatus similar to a victrola, according to a report in *Metals and Alloys*. When the needle passes over the surface it encounters minute hills and valleys which set up vibrations on a diaphragm. A very smooth surface would emit a very high note as the ridges are small and close together, while a coarse surface would give out a bass note. A method for determining the same thing was developed several years ago in France. This made use of the photoelectric cell and is considered by Dr. P. R. Heyl, of the National Bureau of Standards, to be a slightly more accurate gage of smoothness, but the apparatus involved is somewhat more complex. Light was focused on a surface and its reflection directed on a photoelectric cell. Variations in the resulting current indicated the ridges and hollows.

AT temperatures of red and yellow heat that come to within a few hundred degrees of their melting points, carbons and tool steels are now being studied microscopically. A special furnace-like apparatus, developed at Harvard University by Dr. B. A. Rogers, now research associate at the National Bureau of Standards, is being applied by M. Vacher, of the bureau, in looking at the austenitic grains, which determine the hardness of carbon steels, while the metal is at a temperature of about 1,700 degrees Fahrenheit. Carbon dissolved in steel at high temperatures forms particles of materials which are somewhat different from the matrix surrounding them. These substances were first discovered by Sir Roberts-Austen and received his name. Since then others have been found.

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SCIENCE NEWS

Science Service, Washington, D. C.

EXACTNESS OF SPECTROSCOPIC MEASUREMENTS

ACCURACY comparable to that required to measure the distance from New York to Chicago with an error of at most about three inches was ascribed to the spectroscope at the second annual International Spectroscopy Conference meeting on July 21 at the Massachusetts Institute of Technology.

Dr. Ralph A. Sawyer, of the University of Michigan, and Dr. William F. Meggers, of the National Bureau of Standards, told the 150 scientists assembled that the spectroscope is undoubtedly the most accurate instrument of its kind known to science. The super-sensitivity of the instrument is better appreciated when it is realized that instead of measuring a distance of 1,000 miles, the distance from New York to Chicago, the spectroscope measures distances of approximately one eight-thousandths of an inch.

In measuring wave-lengths the ångstrom, defined as one one-hundred-millionth of a centimeter (there being roughly two and one half centimeters in an inch), is used as a unit. Dr. Sawyer said that with the spectroscope in measuring wave-lengths of approximately 5,000 units, accuracy to one part in twenty million had been attained. Scientists have measured wave-lengths to eight significant figures, measuring with accuracy one ten-thousandth of these tiny ångstrom units.

Scientists, however, are not yet satisfied and feel that there is a need of even a higher degree of accuracy. Dr. Sawyer expressed the opinion that with improved equipment and the finer technique that is being steadily developed, this need will be fulfilled within a relatively short time.

This need is particularly felt at present in measuring ultra-violet and infra-red wave-lengths. In visible light, fairly satisfactory standards of measurement have been established. Discussing this point, Dr. Sawyer said he believed that increased dispersion in the use of the spectroscope would aid in eliminating the various types of interference which now hinder the establishment of satisfactory standards.

Dr. Meggers described his work with the so-called noble gases, argon, neon, xenon and krypton. He illustrated his lecture with lantern slides of the spectra of these gases which he has photographed. He explained their remarkable clarity as compared with other spectra shown, as due to the fact that these gases are composed of heavier atoms.

AN ELECTRON MICROSCOPE

A MICROSCOPE which uses electrons instead of light rays to "see" tiny objects has been developed by Dr. E. Ruska and reported in the *Zeitschrift für Physik*. By magnification in two stages a device has been developed capable of enlarging the apparent size of things some 10,000 times. The maximum magnification usually possible with ordinary optical instruments is 3,500 times.

Whether electrons or light rays are used in a micro scope they must be brought to a focus. For electrons magnetic field is used for this purpose since the electron charge makes it react in a magnetic field.

The electron microscope has theoretically a resolving power a thousand times greater than that of a microscop using light, because the wave-length corresponding to th electron is a thousand times shorter than that of ordinar light. But to realize this power, strongly converging short-focus objectives are required. Glass lenses can n be used. Electric or magnetic fields take their place a bend or converge the electron streams just as lenses be or focus light rays.

One could use a series of low power objectives on after the other in a series of stages. But this wou make the microscope unduly long and cumbersome. T development of a high power magnetic objective that w give a magnification of 10,000 diameters in two stages therefore a considerable step in advance.

STANDARDS FOR X- AND GAMMA-RAY INTENSITIES

SUGGESTIONS for standardizing measurements of x-r and gamma-ray intensities which should aid medical s ence in the treatment of cancer by radiation were a vanced by Dr. Gioacchino Failla at the fourth Inter tional Congress on Radiology meeting in Zurich. Failla is chief physicist at Memorial Hospital in N York City and one of five American delegates to t congress.

At present the proper doses of x-rays can be det mined with considerable accuracy, but deciding on t right dose of gamma-rays from radium is less certa In practise, rule-of-thumb tests known from experi often serve as a gauge by which the conflicting and sc tered observations of many investigators are judged.

The present unit for measuring x-ray and gamma-r intensities, according to Dr. Failla, is the roentgen R unit. Two ray beams are now compared by the amo of ionization, or atmospheric electricity, which they produce in a small air chamber at fixed distances fr the source.

For x-rays, where the length of the waves is not short, the method works with some success. For gam rays, having much shorter wave-length, the ioniza method of determining intensity does not work so w This is due in part, Dr. Failla said, to the fact that w really needs to be known about a gamma-ray beam is effect on body tissues.

What science now tries to do is to take ionization p duced in air and apply the results to tissue which is times more dense. For x-rays this discrepancy seems make little difference but it does matter for the m penetrating gamma-rays.

Dr. Failla suggests that the intensity of gamma-r be determined by the ionization they produce in liquid rather than in gaseous air. Liquid air and human tis

do not differ greatly in density. It is to be hoped that conditions could thus be achieved approximating more closely those found in actual treatment.

WATER LEVELS OF RIVERS AFTER THE DROUGHT

THE unparalleled drought in the midwest, soon to enter its fifth month, is showing up in the water-levels of the great rivers—the Mississippi, the Missouri, the Arkansas and the Red—which are approaching new low marks at many stations.

At the Little Rock river gauge, on the Arkansas, readings are the lowest in the history of the station. The readings, prosaically entered on Weather Bureau tables as minus 3.2 feet, reflect what is happening in the 158,000 square miles of land drained by the river above this point.

At St. Louis, where river height records go back seventy-four years to 1860, the gauge reading is the lowest for the month of July in the history of the station. And the same statement holds for the past four months of March, April, May and June.

The Mississippi and its tributaries (principally the Missouri) above St. Louis drains 691,000 square miles of land now drought-stricken.

At Shreveport, Louisiana, on the Red River, levels are low for July but a bit above the all-time low recorded in November, 1932. 60,000 square miles of land are drained by the Red River at this point.

M. W. Hayes, of the River and Flood Division of the Weather Bureau, pointed out that low levels taken indiscriminately throughout the year do not necessarily mean drought, for at many stations low marks come in the winter months when the particular stream under consideration may be frozen as well as its tributaries. Low marks for summer months do have great significance, however.

"Gauge readings of very low stages," Mr. Hayes said, are a guide to the volume of water passing down a river, but they are not an infallible guide simply because the cross-section area of a river often changes either because of silting or erosion." Frequent discharge observations, or measurements of the amount of water carried by a river, are a better guide.

The Great Lakes reflect the dry spell in lower levels. Only Lake Superior is higher than the 10-year June average.

The U. S. Lake Survey Notice to Mariners of the War Department for June lists Lakes Michigan and Huron 1.59 feet lower for that month than the average level for June during the last 10 years. Lake Erie is 1.89 feet lower by the same standard. Lake Ontario is 1.96 feet lower.

Low lake-levels bring trouble for certain harbors whose normal depth of water is only slightly greater than the deepest draught lake steamers. A drop of one foot sometimes means that a large boat may be unable to maneuver properly in the harbor.

AMEBIC DYSENTERY GERMS

THE cysts which transmit amebic dysentery can be filtered out of water by the usual filtration methods used to purify water supplies, according to tests conducted at the Chicago Experimental Filtration Plant.

That chlorination is not a practical method of freeing the water from these organisms has been found by Dr. Bertha Kaplan Spector, of the U. S. Public Health Service, and John R. Baylis and Oscar Gullins, chemists of the Chicago Department of Public Works. Chlorine and chloramine kill the cysts, but the amount necessary is more than could be used in a public water supply. Chlorine is more effective than chloramine.

The outbreak of amebic dysentery in a hotel in Chicago last fall and the possibility that it was caused by contamination of the hotel water from an unknown source emphasized the importance of knowing more about *Endamoeba histolytica*, the organism that causes the disease. It is particularly important to know more about this germ's life outside the human body, how it is transmitted and means of safeguarding the public from infection.

Cysts were used for the tests of water purification methods because they are generally considered the transmittable stage of the organism. Waste material containing these cysts was added to samples of water which were then treated with aluminum sulphate to coagulate the solid matter and filtered through rapid sand filters of a size and type found in many filtration plants throughout the country. All cysts were removed from the water by the treatment.

ITEMS

CHICKEN feathers may come into the market disguised as fountain pens, buttons, and various novelties now made from other plastic materials if the research carried on at Iowa State College becomes commercialized. Immense quantities of chicken feathers are produced every year. Many of these are utilized in such well-known articles as pillows and feather beds, but large quantities go to waste. Research work in the Chemical Engineering Department of Iowa State College has shown that these feathers may dissolve in caustic soda and then be thrown out of solution in a new form by acids. This new material may be molded to any shape and hardened by formaldehyde. The finished material is said to be fairly hard, very elastic, an excellent electrical insulator; resistant to water, heat, dilute acids and alkalies. Somewhat similar plastics are being made commercially from milk casein.

AQUATIC flowers on a strictly land plant is the botanical paradox described by Dr. Alexander F. Skutch, who is now working in Guatemala. The flowers of one species of the plant known as *Heliconia* develop totally submerged in a pool of water held within the tight-fitting fleshy leaves just below the flower cluster. In this pool of water, Dr. Skutch states, the buds develop, protected from the surrounding fluid by equally tight-fitting petals. When the time for pollination comes, the tips of the flowers are above the surface of the water. Hummingbirds serve instead of bees or other insects as the agency of pollen dissemination. Following their visit, the fruit starts to develop, also submerged. When the fruit is ripe, it is carried above the water by the elongation of its stalk.

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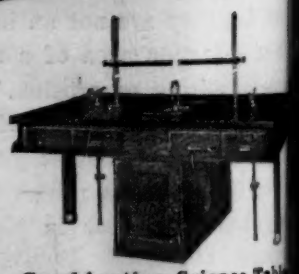

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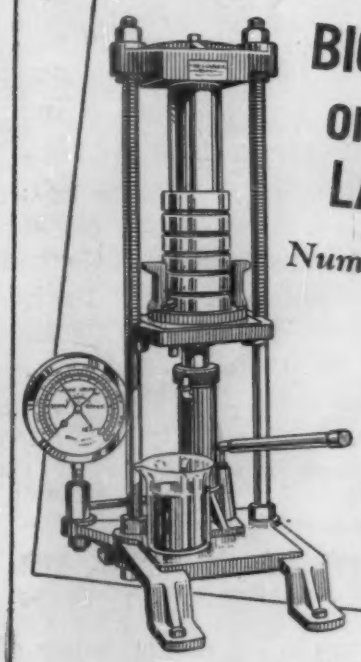

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SCIENCE NEWS

Science Service, Washington, D. C.

THE ORIGIN OF MEN

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Homo sapiens, or man as we know him, has lived longer on the face of the earth than science has hitherto supposed. He rose from among the other primates toward the geologic age known as Miocene. This makes him some 10,000,000 years old.

Discussion on man's place among the primates presented to the International Congress of Anthropological and Ethnological Sciences meeting in London indicate that scientific opinion based on new facts and researches tends to the acceptance of these ideas.

The Oxford anatomist, Professor W. Le Gros Clark, emphasized the paramount importance of American research on the anatomy of the foot and explained that Dr. Dudley J. Morton, of the College of Physicians and Surgeons, Columbia University, finds in the structure of the foot the strong suggestion that the human stock diverged from the anthropoid line of evolution when the common ancestors of man and other primates were little larger than the modern gibbon, a relatively small animal to be seen in most zoological gardens and belonging to the same Simiidae family as the chimpanzee, gorilla and orang-utan.

The Neanderthal man, whose remains have been found plentifully in Europe, is no longer regarded as intermediate in evolution from the troglodyte apes, and man's resemblance to the gorilla is not attributed to the accident of parallel evolution upward from a remote common ancestor.

Of great interest to those who are attempting to puzzle out man's origin is the espousal by Sir G. Elliot Smith of Dr. L. S. B. Leakey's conclusion that the anthropoids branched from the parent stem as early as the Oligocene epoch, the geologic time preceding the Miocene. Dr. Leakey has investigated extensively fossil beds abounding in animal remains near the shores of Lake Victoria in Kenya, East Africa, and he offered his discoveries, Kanam and Kanjera men, as very early types.

Dr. William K. Gregory, of the American Museum of Natural History, joined with Professor G. Pinkley, of the University of London, in putting the Wadjak man, discovered in Java in 1889, into a new niche in human prehistory. This human type is known from a few fossils collected by Dr. Eugene Dubois, also "father" of the famous Pithecanthropus ape-man of Java. Dr. Dubois considered Wadjak man as a forerunner of the modern aboriginal Australians, but Professor Pinkley concluded from a study of the teeth that Wadjak man, instead, foreshadows the Mediterranean type of man which has played a much more important part in the world as we know it to-day.

COSMIC RAY EXPEDITION TO MT. EVANS

BATTLING extremes of temperature and high gales on the summit of Mount Evans in Colorado, members of the department of electrical engineering of the Massachusetts Institute of Technology have completed successfully the first field tests of the largest cosmic ray meter ever constructed.

The object of the expedition, sponsored by the Carnegie Institution of Washington, was to test the meter in a wide variety of atmospheric conditions. The meter, weighing 3,200 pounds, is one of a new type designed by Dr. Arthur H. Compton, and built in the physics laboratories of the University of Chicago.

The heart of the apparatus is a large sphere of lead at whose center is a small chamber containing argon gas compressed to a pressure of 750 pounds to the square inch. The apparatus has an automatic photographic recording device and is compensated for changes in temperature and atmospheric pressure.

The device is one of seven being built for a world-wide survey which will be carried on by the Carnegie Institution over a period of five years. It is expected these heavy meters will operate continuously for the full period of five years. With them it is hoped to learn more about the nature of the mysterious and powerful cosmic rays which continually bombard the earth.

Dr. Compton believes that the results of this investigation will enable the correlation of variations in the intensity of the cosmic radiation with solar or sidereal time, variations in the intensity of the earth's magnetic field, the sun-spot cycle and other phenomena.

The expedition to Mount Evans was under the leadership of Professor Ralph D. Bennett, of the department of electrical engineering at the Massachusetts Institute of Technology. He was accompanied by Gordon S. Brown and Henry Rahmel, of the same department.

Preliminary observations were made on the campus of the University of Denver and at Echo Lake at an elevation of 10,600 feet. The apparatus was then taken to the peak of Mount Evans, 14,120 feet above sea-level, where the barometric pressure is 18 inches, and all the extremes of summer and winter weather may be experienced in the space of a few minutes.

The apparatus is now on its way to Dr. Compton's laboratories at Chicago, where it will be calibrated with the second machine, now in the process of construction.

ECLIPSE OF THE SUN

FOR the second time this year, August 10, the moon will pass in front of the sun, producing an eclipse of that body. The eclipse will be seen from South Africa, but no expeditions from other parts of the world have gone there to observe it. This is an annular eclipse. Even though the moon will come squarely in front of the sun, the corona, the sun's outer layer, visible at a total eclipse, will not appear.

There are three kinds of eclipses. The least important scientifically, is a partial eclipse, when the moon only partly covers the sun, making it appear something like a cookie with a piece bitten out.

A total eclipse, the kind at which valuable observations can be made, occurs when the moon passes directly be-

tween the earth and sun, and over the region traversed by the moon's shadow. The bright disk of the sun is completely covered. But the moon's distance from the earth varies each month, as it makes a complete circuit in its orbit around the earth. Thus, on August 8, it was in apogee, or farthest from us, at a distance of 252,510 miles. On August 23, it will have moved more than 25,000 miles closer, and will be only 226,650 miles away. This is called perigee.

Of course, when farthest from the earth, the moon appears a little smaller than when closest—smaller, even, than the apparent diameter of the sun. Therefore, when an eclipse occurs near apogee, the moon does not completely cover the sun, and even though it may come directly in front, there is a ring of sunlight visible around the dark lunar disk. This is what happens on August 10. The phenomenon is called an annular eclipse from the Latin word "annulus," a ring, referring to the ring of sunlight seen while the eclipse is at its height. The only astronomical observations that can then be made are those to determine the exact time that the moon comes in front of the sun, in order to check the moon's motion.

The two-hundred-mile-wide path through which the eclipse may be seen crosses Angola, Rhodesia and Mozambique, and will be at its height there about 3:00 A. M., eastern standard time. For people in this region, the sun's light will seem to have a peculiar color, because the light that comes to us from the outer edge of the sun is yellowish, and the inner part more bluish. In an annular eclipse the inner part is covered. Over all of the southern half of Africa, a partial eclipse will be seen.

The next total eclipse that will be available for astronomical observations will occur on June 19, 1936. It will be visible along a path crossing Turkey, Siberia and Japan.

SCIENTIFIC RECORD OF THE STRATOSPHERE EXPEDITION

Two complete and valuable scientific records have been salvaged from what at first appeared to be a hopeless tangle of wrecked instruments in the gondola of the ill-fated balloon explorer of the National Geographic-Army Air Corps stratosphere expedition.

One film record is the complete history of cosmic-ray intensity measurements from one of the detectors. The other is a record of temperatures in and out of the gondola, sun and sky brightness, the time of each measurement and the tilt of the gondola during the entire flight.

Finding these two valuable records spurs the hope that elsewhere in the pile of twisted instruments now being shipped to the headquarters of the National Geographic Society there may be other useful records.

With the discovery of the two new records the sum total of results now obtained for the flight include:

1. Salvage of the large spectroscope and its scientific records. This is the instrument which hung on a cable below the gondola and was released on its own parachute.

2. Recovery of part of the records taken on two other spectroscopes inside the gondola.

3. Recovery of both barographs for recording air pressure and hence the altitudes attained during the flight. The high elevation as given by both instruments is 60,613 feet—only 624 feet below the official world's altitude record made on the 1933 flight of Commander Settle and Major Fordney.

4. Proof that a stratosphere balloon can be built whose gondola is livable at extreme heights and that automatic instruments of the type employed worked perfectly. The pneumatic, automatic valve atop the balloon bag worked perfectly at all times.

RADIO FOG NAVIGATION

SCIENTIFIC men in America are finding it difficult to see how the new invention of Marchese Guglielmo Marconi for the blind navigation of vessels in a fog differs greatly from any of several ultra-short-wave radio beacons used in landing airplanes by blind flying. In fact, the case of blind navigation by radio beams for ships seems less difficult, for it is really a two-dimensional problem, while the aviation case is one of three dimensions.

So far as first reports indicate, the essential of the Signor Marconi's new development is to use two radio transmitting sets located on buoys 300 feet apart, one on either side of the ship channel. The incoming vessel finds, with instruments, the halfway mark between the two transmitters where the signal intensity is the same from both sources, and then sails along the line of signal equality. All the master of the vessel has to do is to watch a pointer and keep it centered. As an added aid he has a loudspeaker nearby from which there issue two notes, one of low and the other of high pitch. The line of the channel is found when these two notes are of the same intensity.

Airplane landing beacons used in America apply a principle comparable with that of Marconi. Two transmitters, which may give off either short- or ultra-short-waves, are located at the landing field. They project radio beams at an angle with the ground. The pilot finds his line of equal intensity, just as in the Marconi case, and then "rides" down the line of slope. Not only is he guided as to left and right (as in Marconi's system) but also is kept informed regarding up and down, *i.e.*, whether he is above or below the invisible, sloping radio line.

In marine navigation, where two ships both wish to use a channel beam at one time, collisions are avoided by having each ship keep its path two degrees to the starboard, or right, of the center line. Then the ships may pass one another with a reasonable amount of clearance.

If Marconi uses the comparison of two notes of different pitch to determine his line of the central channel, he is going back to old principles, for it has been demonstrated that it is more difficult for the ear to compare two different notes for the same intensity than it is to compare two notes, each of the same pitch, coming from different sources.

Until the Italian inventor publishes the details of his work in scientific journals it will be difficult to pass satisfactory judgment on the research. At first glance, and using only the present press sources of information, the invention does not appear to use principles not now

known. And by the same picture the work does not appear to solve a problem as difficult as those already encountered in aviation.

FOREST FIRES

LIGHTNING and excessively dry conditions throughout the Northern Pacific States were responsible for over 100 forest fires during the week ending August 4.

High winds fanned one blaze of 3,000 acres near Curlew, Washington, into a roaring furnace covering 18,000 acres. Another fire originating in Canada crossed the border over a three-mile front and entered Coleville National Forest near Vulcan Mountain. Nearly a thousand men from C. C. C. camps and the neighboring region fought the two conflagrations.

Lightning storms caused 45 fires in the Wenatchee National Forest alone. Of the 25 that were burning in the Chelan Forest, three were reported as class C, which means that over ten acres were burned. These three have laid bare a total of 780 acres of heavily wooded landscape.

Conditions in region one, the northern Rockies in Central Idaho and Montana, were reported on August 1 as still critical. Koniksu, Kootenai, Selway, Bitterroot and Clearwater National Forests all have fires. All but one in Koniksu and Kootenai are controlled. In Clearwater Forest a fire raging over 8,000 acres was still burning on August 1. It was, however, reported to be well-manned with C. C. C. crews.

Snoqualmie National Forest, in Washington, has suffered severely from 19 fires. One burned off 1,500 and another 3,000 acres of big timber.

The Forest Service has not as yet computed the extent of the damage done in the West. Reports up to the present time, however, show that this year is heading for a record of destruction from forest fires. Already the 1934 toll points to a 66 per cent. increase over the average for the past three years.

The regions that are being ravaged by numerous outbreaks are very sparsely populated. They are watched over by look-out stations on the tops of mountains, but the number of isolated blazes is so great that all the available men are occupied attempting to bring the larger fires under control.

ITEMS

Two skilled California Institute of Technology workmen have started the largest optical job since the 100-inch mirror was completed for the world's largest telescope on Mount Wilson. Preliminary grinding of the 120-inch pyrex mirror to be used in testing the final surface of the 200-inch "eye," shortly to be recast at Corning, N. Y., is under way. By spring it is expected the surface of the disc will be ground flat to within a hundred thousandth of an inch of perfection. Preliminary grinding is to continue until bubbles on the surface are removed. Machinery weighing between 40 and 50 tons is used to prepare the mirror's face for use, and is housed in a huge one-room, cork-lined laboratory building designed to keep a constant temperature which is needed to prevent distortion of the glass. The grinding tool is fastened to an arm controlled by a series of motors. Each motor gives the tool a different motion over the heavy mirror. One man, at switches, controls these operations. The other watches the progress of the grinding and supplies the necessary amount of carborundum, the grinding substance.

MANY motorists will go into the "movies" unknowingly this summer when science, with photoelectric cell and camera, makes a new survey of traffic problems. The picture-taking will not be promiscuous spying but an attempt to obtain lasting records of traffic snarls at busy intersections. In a survey planned for the State of Ohio by Professor B. D. Greenshields, of Denison University, and Professor R. S. Sminton, of the University of Michigan, a motion picture camera will be placed on a high building overlooking a busy street corner. Every second one picture will be taken. When the pictures are thrown on the screen at the regular rate of 16 pictures, or frames, a second, it will be possible to tell the speed of each car in view, the time lost in slowing up and the number of cars using the intersection. All this can be done by watching the motion of the automobiles with respect to vertical lines marked on the screen.

MOOSE, seldom seen in Yellowstone National Park by casual visitors eight or ten years ago, of recent summers have become one of the interesting tourist sights. This year these animals are being met more than ever along the roads and trails, according to Superintendent Roger W. Toll, of the park, for an abnormally large "crop" of moose calves resulted from the mild winter which turned conditions topsy-turvy in the Yellowstone. In fact, abnormal increase in all game animals had been expected, but indications now are that, except in the case of the moose, the increase was not as large as was anticipated. It has been impossible to make a satisfactory check on the increase of the game herds, however, as the early spring caused them to migrate to the summer range much earlier than usual, and for some reason the general route of migration apparently was abandoned. At present the game animals are found scattered all over the park. As a result the rangers are having difficulties in their attempts to count the various species.

THERE is a record population of trout available to anglers in Yellowstone National Park, this summer, according to a report of the U. S. Bureau of Fisheries. Basing their calculations on the number of eggs collected in the hatcheries this year, government experts estimate 75,000 to 80,000 as a minimum for the trout population. The season's take of eggs is the highest on record. The total muster of 38,190,000 eggs exceeds the mark of 1924, the previous record year, by about 6,000,000. The eggs are secured from trout trapped on their spawning migration. Records show the average yield of eggs per female trout is about 900. Thus it took 42,000 females to produce the number of eggs collected. Fishermen in other National Parks will benefit from the Yellowstone haul. Content with a record number of parent fish in their rivers, the Yellowstone Hatchery will distribute the newly-born small fry among other parks that need restocking.

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SCIENCE NEWS

Science Service, Washington, D. C.

LUMINOUS NIGHT SKIES

AT times there is a strange luminosity in the sky at night. More or less extended areas glow faintly or stretch in bands across the sky. Such bands have been observed simultaneously at widely separated points, such as in Middle-Europe and in Scotland. Although occurring prevailingly in the northern sky, and often mistaken for some form of auroral effect, these bright areas are evidently not of this nature, because the light is steady, the streaks run prevailingly from east to west, and the phenomenon is not accompanied with marked magnetic disturbances as is the case with the aurora.

A thirteen-year study of this phenomenon has been reported by Dr. C. Hoffmeister of the Sonneberg Observatory near Berlin. He finds that it occurs more often when shooting stars are numerous, as at the time of a meteor shower.

A rough connection of the sort had been observed before, and was explained by Dr. Nagaoka, of Japan, as due to dust produced by the disintegration of the meteors. But the careful observations of Dr. Hoffmeister showed that the luminosity sometimes precedes, sometimes follows, a meteoric shower, and sometimes is absent altogether.

The meteors that strike into our atmosphere in April, called the Lyrids, do not produce this luminescence. The Perseids that arrive in August and are very numerous produce relatively little of it. On the other hand, the Leonids, the Geminids, and other lesser showers produce considerable effects. For these reasons Dr. Hoffmeister believes that the dust that causes the luminosity is of cosmic origin and is brought into our atmosphere along with the meteors, instead of being produced after they arrive.

He points out that all these meteor streams that the earth periodically encounters have been produced by the breaking up of comets. This must have produced not only the larger particles that appear in our atmosphere as meteors, but also smaller particles and dust. The latter, encountering no resistance in empty space, travel along with the larger particles, and like the latter become eventually distributed throughout the whole orbit. The Lyrids and the Perseids, he further points out, are derived from two rather old comets that broke up in 1861 and 1862. Their dust has been nearly all swept up.

The sudden injection of cosmic dust into the atmosphere also affects radio reception. The dust particles neutralize the electrified particles that compose the "ionosphere," that reflecting layer that causes radio waves to hug the surface of the earth instead of shooting out into space.

This connection between radio waves and shooting stars had already been independently discovered by Dr. Zanneck of Munich. The investigations of Dr. Hoffmeister now show the cause of that connection, and make it possible, he believes, to predict with greater assurance than before when radio reception will be good and when it will be bad.

DEUTERIUM IN CHEMICAL REACTIONS

THE technique of substituting atoms of deuterium, the "heavy" kind of hydrogen, for the ordinary hydrogen atoms in a substance has disclosed why ammonia breaks up under the action of ultra-violet light.

Professor Hugh S. Taylor, of Princeton University, and Dr. Joseph C. Jungers, exchange research fellow from Louvain University, Belgium, have just described how they solved the breaking down of ammonia by light through the use of heavy hydrogen atoms as "tracers."

When ultra-violet light shines on ammonia, which consists of one atom of nitrogen and three atoms of hydrogen, it breaks up into two things: a free atom of hydrogen and a substance consisting of one nitrogen and two hydrogen atoms in combination.

Ammonia and deuterium gas was mixed in a quartz vessel. This quartz vessel was exposed to ultra-violet light. By passing other light through the vessel and measuring its absorption with a spectrograph, Professor Taylor and Dr. Jungers were able to trace the driving out of the ordinary hydrogen by the deuterium.

First they obtained absorption spectra in which one atom of deuterium had replaced one hydrogen atom. Next they found two atoms of deuterium had worked their way into the mixture. Finally the third deuterium atom replaced the last hydrogen atom in each molecule and they had a substance containing one nitrogen atom and three deuterium atoms. Each step in the process was traced through with the spectrograph. The experiment is described in the current issue of the *Journal of Chemical Physics.*

NEW ELEMENT 93 MAY BE AN ISOTOPE OF NUMBER 91

THE element 93, discovered by Dr. Enrico Fermi of the University of Rome, may not be a new element after all but merely a different form of element 91, already known. This is the conclusion of Drs. A. V. Grosse and M. Agruss of the department of chemistry of the University of Chicago, who report that Fermi's super-heavy element 93 may very well be an isotope of element 91 and not, therefore, a completely new element as supposed. A letter to the editor of the *Physical Review* reports that by using the chemical tests which Dr. Fermi employed to prove the nature of his element 93, the same set of reactions was obtained by working with element 91. They found, for example, that element 91 is precipitated by the use of manganese from acid solution.

The similar results raise the natural question about the reality of Dr. Fermi's element 93 Drs. Grosse and Agruss write: "We are forced to conclude (unless evidence to the contrary is provided) that the product of uranium with a half period of 13 minutes (referring to Fermi's element) is an isotope of element 91."

It had been supposed that when Dr. Fermi shot neutrons at uranium (element 92) some of them stuck in the nucleus and created element 93. Drs. Grosse and

Agruss believe, however, that the uranium was broken up from element 92 into element 91. The atomic change was a breaking down instead of a building up process.

CHEMICAL ANALYSIS BY X-RAYS

BY holding a piece of metal up to a beam of x-rays it is now possible to tell quickly what are its chemical constituents. This is the seemingly magical method of analyzing metallic substances announced by Dr. L. V. Hamos of Stockholm.

Dr. Hamos has already built metallic "sandwiches" consisting of paper-like strips of metal piled one on top of the other. By shining x-rays at the laminated edge of the metal "sandwich" he has been able to tell what kind of metal was used for each layer. In some cases the edge of the metal strips was only 1/250 of an inch thick.

Reporting his new method of chemical analysis to *Nature*, Dr. Hamos explains that when the initial beam of x-rays (all of the same wave length) strikes the laminated edge it produces secondary x-rays, which come off from each of the various kinds of metal illuminated by the primary beam. These secondary x-rays are characteristic for each different kind of metal known, so that if the "fingerprint rays" could be sorted out in some fashion a chemical identification is possible.

The apparatus for analyzing the tell-tale secondary x-rays consists of a crystal of pure salt shaped into the form of a cylinder. This cylinder does for the mixed-up secondary x-rays what an ordinary prism of glass or a spectrum grating does for white light—it breaks it up into its colors, or wave lengths. As the x-rays come from the salt crystal they strike a photographic plate at different places and leave marks which distinguish each metal present in the original sample of metal.

Dr. Hamos is carrying out his research in the Riksmuseets Mineralogiska Avdelning. His method is adapted for the rapid analysis of metals and metallic ores where the physical appearance of the sample must not be changed. At present he can identify two metals when they are only 1/250 of an inch apart in the samples.

RACIAL CONNECTIONS TOLD BY FINGERPRINT READINGS

A NEW method of reading a man's race or nationality from his fingerprints, was demonstrated in London before the meeting of the International Congress of Anthropological and Ethnological Sciences.

The method was worked out by Dr. Heinrich Poll, the displaced director of the Anatomical Institute at Hamburg, Germany. Dr. Poll, who spent twenty-seven years of research on this task, was followed on the program by Dr. Harold Cummins, professor of anatomy at Tulane University Medical School, who endorsed his conclusions.

Dr. Poll's method is based on certain numerical correlations between a person's fingerprint patterns and his race, his physiological makeup, even his tendencies toward contracting certain diseases. He has developed a shorthand system of expressing these racial fingerprint patterns. Thus, the "formula" for average English fingerprints is 1–07, for Scandinavians it is 1–17, for Italians 1–72, for Spaniards 1–74. Moorish fingerprints have a formula of 1–83, while that of Jews is 2–17. Average fingerprints of American Indians give a reading of 2–26, Chinese prints read 2–49, and Eskimos 2–74. Lesser degrees of difference can be found between tribes or sub-races.

Dr. Poll has also found correlations between certain types of fingerprint patterns and a tendency to develop schizophrenia, or "split personality," and also a similar correlation between fingerprint pattern and a tendency to poliomyelitis, or infantile paralysis.

TEETH OF SAUROPODS

QUESTION MARK QUARRY near Billings, Mont., now being "mined" for dinosaur fossils by the American Museum-Sinclair Dinosaur Expedition under the leadership of Dr. Barnum Brown, may at last be on the eve of yielding a skull, to "head up" at least one of the hitherto quite skull-less dozen saurian skeletons found piled together as in a titanic charnel-house. Dr. Brown describes the find in a statement given to Science Service:

"The first trace of the whereabouts of any of the skulls of the twelve sauropods in the fossil deposits on which we are working, is a group of eight teeth lying parallel and evidently in normal position close to and partly beneath a large vertebra. The roots of the teeth, which are about two inches long but very narrow, extend into thin bone which I believe to be part of the skull.

"The finding of this skull is a matter of vast relief as all other parts of a skeleton have been discovered and naturally headless sauropods would not make a complete exhibit. An important angle of the finding of the teeth is that they give the first indication of the type of sauropod we are dealing with. Such casual study as I have given them indicate that the creature to which they belonged may have been a hitherto undescribed type of Barosaurus, of which no skull has ever been found.

"It goes without saying that we are going ahead with the greatest possible vigilance so that not a bone fragment will escape us."

If Dr. Brown's conjecture that the teeth and possible skull fragment belong to a Barosaur, the find will be of outstanding importance, for though skeletons of this type of dinosaur have been found in the past, none of them has ever had a skull with it. The Barosaurs resembled the Diplodocus type of dinosaur—enormous potbellied creatures that walked on all fours, with tremendously long necks and even longer tapering tails. Diplodocus heads were ridiculously small, in comparison to their huge size; it is not improbable that Barosaur heads resembled them. Dr. Brown's new find may help to throw light on this point.

TYPHOID FOLLOWING THE DROUGHT

UNDUE alarm need not be felt over the recent increase in numbers of typhoid cases reported, although the situation in a few states is admittedly serious and calls for careful watching. This summarizes the opinion of U. S. Public Health Service officials, who have been checking up on figures received from the health authorities of the various states. Even in the states showing the largest increases, the outbreaks can not be properly characterized as epidemics.

The area most carefully studied comprises the "drought belt" states of Indiana, Illinois, Missouri, the Dakotas, Nebraska, Kansas, Oklahoma and Texas. Some communities in these states, particularly the smaller towns, have had to resort to secondary and often unsuitable water supplies because of the exhaustion of normal stocks, and here, it is felt, the danger of contamination and disease has been greatest.

However, in only three of the states has there been a really spectacular jump in the number of typhoid cases. For the week ending July 28, the latest period for which complete figures are available, Missouri showed 66 cases of typhoid, an increase of 43 over the corresponding week in July, 1933. Illinois reported 61 cases, an increase of 37, and Kansas showed a jump of 23 cases over the previous year's record for that week—from 6 in 1933 to 29 in 1934. On the other hand, Oklahoma showed a decrease of 6 cases, from 39 in 1933 to 33 this year. Texas showed an even larger decline of 15 cases, from 103 for the week in 1933 to 86 for the corresponding week of 1934. The other states in the list show a very low incidence—only one or two cases apiece for the whole week.

Considerable fluctuations occur from week to week in the development of typhoid cases. Thus, for the week preceding, ending July 21, Illinois showed an increase of only 13 cases over the corresponding week in 1933, in place of the 37-case increase reported on the last Friday in July. Similarly, the increase for Kansas during the week ending July 21 was only four cases, as against 23 for the following week.

Surgeon-General Hugh S. Cumming, of the U. S. Public Health Service, holds to his previously expressed view, that the typhoid situation can be handled adequately by local health authorities, even though they have in some localities been handicapped by drastic reduction in working funds. Individuals in typhoid-threatened communities can do much for their own protection, too, he says, by boiling milk and drinking water, and by exercising caution in the preparation and use of uncooked foods.

ITEMS

DROUGHT-RESISTANT grass species, to be used in rebuilding the depleted rangelands of the West, are to be sought in central Asia by an expedition being sent out by the U. S. Department of Agriculture. On the edge of the Gobi Desert there are great natural grasslands, which have been pastured for thousands of years by nomad tribes, without any sign of exhaustion. In this region the temperature ranges from 100 degrees Fahrenheit in the summer to 40 degrees below zero in the winter, and severe droughts are frequent. Yet the grasses survive, and the herds of livestock and game thrive on them. The leader of the expedition will be Professor Nicholas Roerich, veteran explorer of interior Asia, from Kashmir to the Altai mountains. With him will be his son, George Roerich, an expert in Central Asiatic languages, and two U. S. Department of Agriculture specialists in grasses, H. G. MacMillan and J. L. Stephens.

THE skull of a unique species of extinct rhinoceros has been discovered by a party of investigators from the California Institute of Technology, working in the fossil-rich John Day Beds in Oregon. The specimen, which is the most complete rhinoceros skull found in this region for many years, shows by its outline that the animal had an extended proboscis, instead of the bluntly rounded nose of modern rhino species. The skull found while Dr. Chester A. Stock, paleontologist, and Eustace L. Furlong, curator, were scouting for new beds to explore, contains a full upper set of teeth, including the front teeth that form the "schnozzle." The lower jaw was in fragments, most of which had disappeared. The fossil was removed from Miocene geologic strata, giving the animal an age of at least 10,000,000 years.

A SMALL "electric village" is about to be opened in Germany to demonstrate to farmers the uses of electric power. The purpose of this project, according to a report from the U. S. Department of Commerce, is to create an outlet for a local power plant as well as to demonstrate that electricity is not too expensive a source of light, power and heat. The appliances to be installed in the farmers' homes will be supplied free by the power company. The only cost that the farmer bears is that of the current consumed. The village of Saulwitz in Prussia is to be the scene of this experiment.

A NEW type of watch studied by R. E. Gould, of the National Bureau of Standards, has its critical parts, hair-spring and balance wheel, fabricated of non-magnetic metal. "Elinvar," a nickel-steel alloy, is used for the hair-spring because it does not become sluggish after being exposed to small electric currents. The use of elinvar further simplifies the construction of a watch because it also automatically compensates the effects of heat and cold and eliminates the intricate construction normally necessary to prevent changes in size of the balance wheel with temperature. In carefully conducted tests covering nearly all conditions forty different watches were compared. Those with non-magnetic hair-springs were more accurate.

SLIME-PRODUCING micro-organisms that are a harmful factor in the pulp and paper industry have been turned to practical account by Dr. J. R. Sanborn, of the International Paper Company. These organisms, Dr. Sanborn reported to the Society of American Bacteriologists, will form, under special methods of cultivation, doughy or rubbery slime clots. The clots are converted by agitation in water into a cellulose-like suspension. This is deposited in a thin layer and the water is withdrawn. The slime particles merge or coalesce, forming a continuous membrane. The completed sheet is semi-transparent and parchment-like.

MORE radium exists in the mud of the sea than in the ordinary rocks of dry land, according to Dr. Robley D. Evans, of the University of California. His tests show that radium is being deposited constantly by the oceanic waters. There is no hope of mining sea mud for radium activity. Dr. Evans made his experiments merely to test his new method of detecting extremely minute amounts of radium and radon gas emitted by radium. Each ounce of mud contains three trillionths of an ounce of radium.

SCIENCE NEWS

Science Service, Washington, D. C.

ENERGY WITHIN ATOMS

ATOMS seem to have within their hard and heavy central cores a large variety of energy stages, two Rice Institute investigators have discovered after taking over 20,000 photographs in atom-smashing experiments. In the laboratory of Professor L. M. Mott-Smith and Dr. T. W. Bonner atoms were made to shoot off neutrons. From the way these neutrons collided with neighboring gas atoms it appears as if the core, or nucleus, of an atom may be likened to a fortress firing projectiles at the enemy.

The observers found that all the atomic projectiles did not strike with the same energy. Some were powerful as if from 16-inch guns; others were more like rifle fire. Within the atom, it is believed, the different strengths of the "guns" correspond to the different states of energy which drive off the atom particles.

Important to science is the discovery, for instance, that the light and comparatively rare element beryllium has within its nuclear core 20 or more different steps of energy, 20 different atomic "guns" of varying caliber. Scientists have been thinking of energy within the atom as having only a few levels.

To make the atoms shoot off the various particles and to make possible some estimate of the energy forces producing them, Professor Mott-Smith and Dr. Bonner bombarded targets of calcium fluoride, boron and beryllium with alpha particles, or helium nuclei, like those given off by radium. When they did this the atoms of the target liberated non-electrical particles called neutrons. These neutrons shoot off into a chamber filled with gas atoms where they could collide with the gas atoms present. This impact was the "battlefront" on which the scientists watched to learn the atomic secrets.

Through the quartz window in their apparatus, called a Wilson cloud chamber after its inventor, Professor C. T. R. Wilson of England, the collisions of the neutrons and the gas atoms were photographed. As the neutrons hit the gas atoms they drove out little bundles of light that physicists call photons. The range of the photon tracks is a measure of the neutrons' energy; and in turn, a measure of the energy forces within the atoms of the target.

Some 21,000 atomic "battlefront" pictures were obtained, report the Rice Institute scientists. Nine thousand snapshots were made when the calcium fluoride target was giving off the neutrons, 4,000 were taken with boron as the target, and 8,000 more when beryllium was used.

In no case were the neutrons given off in constant energy groups. The range of the recoil light packets—the photons—fell, instead, into different groups. Some would bounce back a certain distance; others would travel farther before stopping. The range observed is a measure of the neutron "bullets" just as the penetration of a real bullet into a block of wood is a measure of its energy.

Analyzing thousands of photographs, it was found that in fluorine there were five different groups of neutrons emitted. The more energetic was equivalent to 2,500,000 electron volts energy.

For boron eight groups of neutron energies were found. The strongest was equal to 4,160,000 volts energy. For beryllium there were over 20 groups and the maximum energy detected was 11,700,000 volts. The experiments of Drs. Mott-Smith and Bonner are published in the *Physical Review*.

NEUTRONS FROM ARTIFICIALLY RADIOACTIVE ELEMENTS

NEUTRONS have hitherto been produced only by the bombardment of atoms, and have ceased to be emitted when the bombardment stopped. Now comes the announcement from the Paris Academy of Sciences that Irene Curie, F. Joliot, and P. Preiswerk have observed neutrons to be given off bombarded phosphorus for as much as three hours after the bombardment had ceased. The spontaneous emission of neutrons is a new form of radioactivity.

The discovery was not made by accident. The investigators had been bombarding various elements with helium cores (alpha particles), and with neutrons. In the case of phosphorus they found that the artificial radioactivity produced was of two sorts. One had a half life of two minutes forty-five seconds, as had already been discovered by Dr. E. Fermi of Rome. The other had a half life of over three hours.

In studying the possible reactions that might give rise to these radiations the scientists found that one of these possible reactions should result in the emission of neutrons. Accordingly they set up the special apparatus required for the detection of neutrons, and found that neutrons were in fact emitted.

In this process they believe that two unstable atoms are produced. One of them is aluminum with an atomic weight 28. Ordinary aluminum has an atomic weight 27. The other atom is silicon with an atomic weight 31. Ordinary silicon is of weight 28, 29, or 30. Both of these top-heavy atoms disintegrate, according to the reactions worked out by the experimenters, with the production of neutrons.

DISINTEGRATION OF ATOMS OF HEAVY HYDROGEN

GAMMA rays, the same kind of radiation used medically for the treatment of cancer, are now being employed to produce artificial disintegration of atoms of the "heavy" hydrogen isotope, deuterium. The atom breakup achieved throws new light on the composition of the newly discovered "heavyweight" hydrogen. Professor James Chadwick and Dr. M. Goldhaber of the University of Cambridge report to *Nature* that by bombarding diplons (deuterium atoms which have lost an electron and become ionized) with gamma rays having energies of 2,620,000 volts they have produced ordinary lightweight hydrogen and neutrons.

Diplons are known in America as deutons. They are favored there as particles with which to bombard other substances and so create disintegration. As ionized atoms of deuterium, diplons have twice the weight of ordinary hydrogen. Drs. Chadwick and Goldhaber indicate that to break down the diplons into their two constituent parts the bombarding gamma rays must have energies greater than the forces which normally hold the particles together. This condition is satisfied with gamma rays of 2,620,000 electron-volts energy.

The new discovery is expected to make possible more accurate estimates of how much a neutron weighs, a point on which various investigators differ at the present time.

A neutron, it will be recalled, is thought by some to be a composite particle consisting of an extremely close union of particles with positive and negative charges so tightly bound that there is no measurable external electric field. It weighs as much as a hydrogen atom but is much more tiny, and hence more penetrating when it strikes some other substance. So piercing is a neutron that it is difficult to distinguish between it and packets of radiation called photons.

THE ROCKSLIDE OF NIAGARA FALLS

NIAGARA has again created a nation-wide sensation by staging a rock-slide on Monday, August 13. Doubtless it will arouse all over again the discussion of various projects for "saving" the falls from the fate their natural erosion may bring them, as it did the last time there was a good-sized rock fall, on January 17, 1931. But it's all a very old story to Niagara.

Some time between twenty-five and fifty thousand years ago, when the Ice Age on this continent was just ending and the Great Lakes, as we know them today, were still young, there were five Niagaras instead of only one. The remains of these great falls have been found by geologists at a point quite remote from their single surviving sister. They thundered for centuries, with no human ear to hear them, in the region where Syracuse now stands. They were left high and dry when the level of the upper great lakes fell, and all the outlet-water was concentrated in a single river, the modern Niagara. When the modern falls first started running they were about seven miles down-river from their present position. They have been backing up ever since, so that the recent rock fall is only a trifling incident in the whole history of the carving of the Niagara gorge.

The existence of Niagara Falls depends on the presence of a sheet of hard limestone overlying a thick bed of less resistant sandstones and shale. The churning water at the bottom of the falls, filled with broken fragments of hard rock, carves away the softer material from under the over-hanging edge whence the waters leap. From time to time pieces of the limestone break off. Usually they are small; the slide of August 13, and the one that occurred three years ago were exceptions. Thus the falls keep young by constantly peeling off bits of their face.

The history of the falls has been the same throughout their millennia of life up to the present. There will come a time, however, when there will be no more Niagara as we know it to-day, but a tumultuous series of cataracts dashing through tumbled gigantic blocks of stone.

This is because the capstone which forms the river-b at Niagara dips slightly toward the south. Several mi upstream it disappears under a stratum of softer ro which is not capable of forming a resistant rimrock f the river to jump from. When the river finally backs to this place, it will scour down through the soft st until it finds the limestone, break this up in great pie and thereafter flow foaming and spouting through obstacles it will thus pile up for itself.

SPECTRUM MEASUREMENTS OF VITAM E AND BIOLOGICAL ACTIVITY

THE long-held hope that the fertility vitamin E wo absorb light in a distinct, characteristic fashion and t make possible a positive identification appears to h been achieved by workers at the Dunn Nutritional L oratory of the University of Cambridge, Drs. A. J. Martin, T. Moore, Marion Schmidt and F. P. Bowd who describe in *Nature* experiments on the spectr analysis of vitamin E.

Spectrum analysis is the method in which light af passing through a slit is bent, either by a prism of gl or by a ruled grating, so that its different wavelen or colors are separated into a rainbow-like image of original slit. Every substance in nature, it is found, its spectrum lines at particular positions. Thus eleme like hydrogen, iron, etc., or the various combinations elements that make up compounds can be identified something akin to fingerprints in man. By dissolv vitamin E, prepared from wheat germ seeds, in alc it was found that a sharp absorption occurred at wavelength 2900 Angstroms when they shone light thro it. This wavelength is in the invisible ultraviolet reg right near the actinic rays of light which produce sunbu

The key test in the research was to show that the v min E which produced this characteristic absorption re produced a biological effect when given to experime animals. Such an effect was found, say the investi tors, "for the vitamin caused a female rat which shown characteristic resorption gestation to produc litter of eight live young."

ALPHA CELLULOSE FROM ASPEN TRE

Two years of chemical research by investigators at University of Minnesota have resulted in the perfect of a process for obtaining alpha cellulose, a cotton- substance used in cellophane, rayon and lacquers, f the aspen tree, also known as the "popple" or pop which abounds in the cutover lands of northern Mi sota.

"Our laboratory experiments indicate that this p uct can be obtained from the aspen at a cost that compare with prices now prevailing on the comme market," Professor L. H. Reyerson, director of Northwest Research Institute, stated in announcing new development. "Our next step is to set up a s commercial plant, turning out perhaps 500 pounds alpha cellulose a day, where we can determine accura the cost of production."

The potential value of this development is appreci when it is realized that alpha cellulose is a major

material of many large chemical companies, and yet only two large concerns are to-day supplying it to the market. At present, some 300 million pounds annually are required to meet commercial needs in the United States alone, and research is constantly developing new uses for it. One cord of aspen produces 1,600 pounds of alpha cellulose. There is enough marketable aspen in Minnesota to supply the nation's need for more than 25 years. The current market price is about 5 cents a pound, making this marketable aspen worth $400,000,000.

The alpha cellulose turned out by this process has a purity comparable to the best now on the market, Dr. Reyerson claims. The process also makes it possible to control the viscosity of the product. Thus alpha cellulose with high viscosity could be produced for use as rayon, while it could be made with low viscosity for use in lacquers. At present, the chemical companies must process the alpha cellulose themselves to obtain the desired qualities.

Dr. R. E. Montonna, of the School of Chemistry, has been in charge of the research work on aspen, with Dr. L. Wallace Cornell doing much of the active work. Assisting them have been Dr. R. A. Gorbner, Henry Schmitz, chief of the forestry division, and Samuel I. Aronovsky.

CHARTS FOR AVIATORS

To guide speeding airplanes for 12,000 miles over Europe and Asia, a complete chart of the course of the Macrobertson International Air Race, to take place between England and Australia this fall, has been published by the U. S. Hydrographic Office of the Navy Department. In being the first to print special maps of not only the course but the 25 airports along it, the Hydrographic Office reflects the same interest in the race which has caused U. S. aviators to make the longest list of entries. A map of the path over which 64 planes will fly on or about October 20 appears on the reverse side of the August "Pilot Chart of the Upper Air." In addition a booklet has been published giving a complete list of landing fields and topographical features.

The route, over which it has been estimated the winner will have to achieve average speeds of from 225 to 250 miles per hour, extends from London, over central Europe and Turkey, to Baghdad. From there it crosses Persia to Allahabad, near Calcutta. The airway then passes intermittently over sea and tropical jungle as it skirts the Malay States, Sumatra, Borneo, and part of the Indian Ocean before it reaches northern Australia. The last lap stretches for 2,170 miles over mountains and barren desert until Melbourne, on the southeastern extremity of the continent, looms in sight.

Pilots of 13 countries will compete for prizes amounting to $75,000 in U. S. money. Of the 64 planes slated to take off from Hatfield Airport near London, 29 will bear the brand, "Made in U. S. A." Seven of these are to be flown by pilots representing foreign nations. Numbered among the competitors are four American women who will compete for the $2,500 gold cup and additional $50,000 prize money. The Irish Hospitals' Trust is sponsoring the race. The prizes are offered by Sir MacPherson Macrobertson, millionaire chocolate-candy manufacturer of Melbourne.

The Hydrographic Office maps are to be distributed in England by the Standard Oil Company of New York.

ITEMS

Two unusual meteor photographs were captured at the University of Toronto's Dunlap Observatory by Dr. P. M. Millman during observations of the Perseid meteor shower. They are rainbows or spectra taken with special red sensitive plates. It is expected that they will give new information about the composition of the meteors.

SUGGESTIONS that the neutral atomic building block—the neutron—may consist of a central negatively charged core and positively charged electron, have been made by Dr. Schuler and Dr. Th. Schmidt, of the Astrophysical Institute of Potsdam. Since the usual view of a neutron's make-up is that it consists of a positively-charged nucleus—a proton—plus a negatively charged electron, the new reverse picture would make the neutron an "inside-out" particle.

DR. W. W. PERRETT, Moravian missionary stationed at Hopedale, Labrador, has been keeping a log of radio reception on his set since 1925 and finds that the height of the ocean tide indicates times of good and bad reception, especially fading. The ocean tides, of course, are caused by, and follow, the position of the moon. Despite the fact that Dr. Perrett is very near the "home" of the Aurora Borealis, or Northern Lights, this phenomenon does not markedly influence radio reception at his station. The correlation between tides and radio was described by Dr. Perrett in a communication to E. F. McDonald, Jr., president of the Zenith Radio Corporation of Chicago. In finding that the moon exerts a positive effect on radio, Dr. Perrett is confirming results already obtained by Professor Harlan T. Stetson, astronomer at Perkins Observatory, and Dr. G. W. Kenrick and G. W. Pickard.

VENUS, the planet perpetually enshrouded in a fog-like atmosphere, has great quantities of carbon dioxide in the air above it. Investigation by Drs. Walter S. Adams and Theodore Dunham, Jr., of the Mt. Wilson Observatory, demonstrated the existence of carbon dioxide on Venus in 1932, but an estimate of the quantity present was virtually impossible because it was not known how much the gas absorbed light passing through it. Dr. Arthur Adel, of the University of Michigan, reports in a letter to the *Physical Review* that he has succeeded in obtaining the same carbon dioxide absorption bands in the laboratory as the Mt. Wilson astronomers found in the light from Venus. Dr. Adel's measurements make it possible to form an estimate of the quantity of carbon dioxide present in the planet. "In the upper strata alone," he says, "Venus possesses 10,000 times as much carbon dioxide as is present in the entire atmosphere of the earth."

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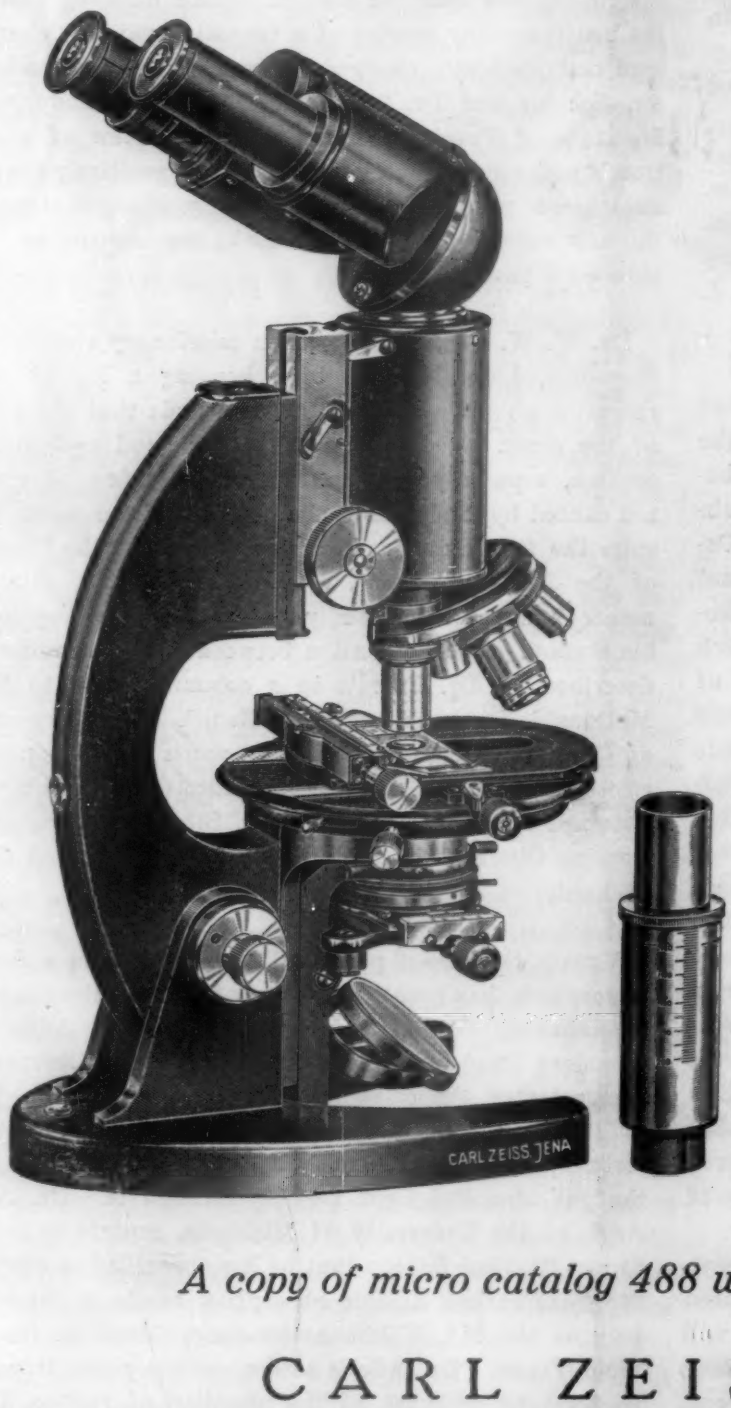

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SCIENCE NEWS

Science Service, Washington, D. C.

PILOTLESS BALLOONS TO EXPLORE THE STRATOSPHERE

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SMALL stratosphere balloons without pilots and using tiny radio transmitters to send back upper air information to earth-bound scientists will make possible a whole new program of cosmic ray studies, Dr. Arthur H. Compton, of the University of Chicago, reports to Science Service.

Preliminary announcement of the little 15-feet diameter balloons which send to earth information on air pressure, air temperature and the intensity of cosmic radiation at various altitudes was recently made. How all this information could be obtained from a single radio signal has never been disclosed. Now, Dr. Compton describes the operation of the device which may revolutionize stratosphere ballooning, especially its costs and hazards.

The small balloons—quite Lilliputian in size compared with the great 3,000,000 cubic feet bag of the recent National Geographic Society and U. S. Army Air Corps flight—weigh only 16 pounds when sent aloft by a bag whose largest extended diameter is but 15 feet.

The radio "voice" sending back the information to earth is a single tube oscillator transmitting a signal on 20 meters wave-length. A barometer, a thermometer and a cosmic ray meter affect the radio signal in such a way that accurate records of these conditions can be learned. A similar short-wave oscillator is kept in continuous operation.

The changing conditions in a special barometer vary the frequency (or what is the same thing, the wave-length) of the transmitted wave. Air pressure, and hence altitude, are thus determined by the "wobble" in the incoming radio signal.

The temperature is recorded by vibrations of a balance wheel somewhat like that of a watch, whose period, or time of oscillation, is affected by the temperature. This mechanical oscillator interrupts the carrier wave at each vibration. Thus the radio signal comes on and then goes off at intervals. The difference in length of the time intervals determines the temperature.

Cosmic ray intensities are determined by the current in the cosmic ray meter produced by ionization. The instrument is charged up to some value. As the cosmic rays make the surrounding air conducting, the electrical charge of the instrument leaks away. How rapidly the leakage occurs depends on how intense are the cosmic rays. Each complete discharge of the cosmic ray meter is noted by interruptions in the carrier radio wave.

All that is necessary in the ground laboratory, then, are instruments which make a record of the wave-length of the radio signal (this tells the air pressure and hence the elevation), and detect interruptions in the radio signal telling temperature and cosmic ray intensity.

Studies of the upper atmosphere, Dr. Compton indicates, have been made before by the system of sending up automatic recording instruments on two small balloons of different sizes. Together the twin bags carry the apparatus aloft until finally the smaller one bursts.

The remaining balloon is insufficient in size to keep up the ascent so that the apparatus descends to the ground in gentle fashion. Reward notices are attached to the whole unit payable on returning the apparatus. Good results have been obtained with this method by the German scientists Hess and Kolhorster and Professor R. A. Millikan in the United States.

While valuable, the method has one defect, however. It is adaptable only in regions of the world having a fairly dense population; where there is some assurance of finding the balloon and its instruments and having it returned. Europe, the United States and southern Canada comprise the regions of usefulness of the method.

Radio balloon apparatus, however, is sent up with little hope—and no need—of its recovery. The cost of $100 for each flight is only a few times that of an airplane flight and only a small fraction of the cost of a manballoon ascension.

"We do not expect," concludes Dr. Compton, "that this radio transmission method of obtaining cosmic ray data from the stratosphere will replace measurements made in large balloons of the stratosphere type, because some kinds of measurements can only be made with equipment too heavy for small balloons to carry. Much information, however, can be obtained with these light balloons. This will supplement, in regions difficult of access, the more detailed information which the large balloons give us in ordinary latitudes."

Near the North magnetic pole of the earth, in the wilds of northern Canada, is expected to be one place where small radio balloons will be especially useful.

The difficulties of transporting and launching a large manned balloon in the wilderness and the hazards which the balloonists would face on the landing exclude this method from any scientific program.

The chances of recovering instruments by reward would also be small, so that the radio type balloon seems to be the one solution to the problem in wild regions. Yet stratosphere measurements at the North magnetic pole would be among the most interesting of all. Ground measurements have been made at this point, but upper information is needed to supplement them.

Professor J. M. Benade, of Forman Christian College at Lahore, India, developed the idea of using radio signals to transmit cosmic ray intensities.

SODIUM VAPOR LAMPS

THE new lamps filled with sodium vapor which are gradually coming into use for highway illumination have no special advantages or disadvantages for indoor clerical use. This is the report of Dr. James E. Ives, senior physicist of the U. S. Public Health Service, in announcing the result of a three months' test to learn whether the striking yellow-glow lamps held special merits for indoor work.

CWA clerical workers served as test subjects for the investigation held in New York City. By checks on speed and amount of work accomplished, and comparison tests of the eyesight of the subjects before and after undergoing the test, the following results are reported: 1. Sodium light has no permanent effect on the eyes which could be detected by clinical tests after the subjects had worked for 4 hours a day over a period of 12 weeks in the yellow light. 2. No significant difference in the amount of work performed by the groups of men working under sodium and tungsten lamps could be observed.

Sodium vapor lamps have come into use recently because of the great saving in the amount of electric current necessary to produce the same intensity of light. It costs only about one fourth as much to operate sodium vapor lamps as it does for tungsten filament lamps.

Experimental highways have been set up at Schenectady, N. Y., in New York City and in New England which are illuminated with the new type lamps. It has been maintained that drivers on these roads find they can drive at night at high speeds without using headlights and yet see approaching cars distinctly.

Because the light from the lamps is brilliant yellow and almost completely of one single wave-length—the familiar D lines of the sodium spectrum—the visual acuity, or distinctness of the edges of objects, is better than under more normal radiation. It has been suggested that chromatic aberration should be absent for light of a single wave-length. Chromatic aberration means essentially that the various colors are not brought to the same focal point by the lens of the eye and a slight blur usually surrounds objects as a result. The effect is noticeable on very small objects and varies among different people.

While there is a definite gain in economy in using sodium vapor lamps, the single color of the light makes it impossible to perform any type of task dependent on color. Curious effects are obtained when color work is attempted under the yellow lights. On highways so illuminated, for example, green leaves all appear white, and a green field looks as if it were covered with snow.

THE SPEED OF RADIO WAVES

THE time required for short radio waves to travel between two distant points fluctuates constantly and rapidly by night to the extent of about ten per cent., whereas by day there is almost no fluctuation. This is the substance of a report made to the Paris Academy of Sciences by Dr. B. Decaux and Dr. J. B. Galle.

The method used was to send the note of an organ pipe from Paris to Algiers on a radio wave of 24.15 meters, and to return it from there to Paris on a wave-length of 24.65 meters. The note received in Paris was then combined with the direct note from the original organ pipe, reduced to the same intensity, in a cathode ray oscillograph.

In this instrument the outgoing note caused a beam of electrons to vibrate in a vertical direction, the incoming note caused it to vibrate in a horizontal direction. The results of the combined vibrations was to cause a little spot of light, produced by the electrons on a screen, to travel around in an oval or ellipse, called a Lissajou figure. Any variation in the time required for the radio signal to travel from Paris to Algiers and back was indicated at once by a change in the form of this figure. The ellipse became either flatter or rounder.

At night the figure continually changed its form so rapidly that the changes could not be followed. They showed that the time required for the signal to travel to Algiers and back varied by 1/1000 second, the whole time required for the journey being about 1/100 second. During the day the figure remained quite steady.

The same phenomena were observed with waves of 33 meters and even of 349 meters. With the long wave, however, which is within the broadcast range for the United States, the fluctuations were much less rapid.

Radio waves, when traveling long distances are reflected back and forth between the earth's surface and a reflecting layer high above the surface. Because of this zig-zag path, the time of travel between two distant points is greater than if the waves followed the earth's surface. The fluctuations in time shown by the experiments of Drs. Decaux and Galle indicate that the height of the reflecting layer is continually changing at night, but remains at a fairly constant level during the day.

THE TRANSPLANTATIONS OF SEX GLAND

SEX gland transplantations, one of the most-discussed of recent medical developments, had relatively little effect when tried on cattle in a series of experiments performed by Dr. Fred W. Miller, R. R. Graves and Dr. G. T. Creech, of the U. S. Department of Agriculture.

Their results are not in accord with the claims made for the famous Voronoff operation on livestock, which has been widely used as a means for rejuvenating aged but once valuable breeding animals, especially in France and the U. S. S. R.

Normal ovarian tissue was implanted in the bodies of several dairy cows which had various types of abnormalities in their reproductive organs, and also into two normally pregnant cows. In no case was there any apparent benefit to the sick cows, or harm to the pregnant animals.

Male sex gland tissue was also implanted in several bulls that had become old and useless for breeding purposes, as well as one young animal in a subnormal physical condition. After the operation, the old bulls were noticeably "pepped up" and aggressive, but their usefulness as breeding stock was not improved. There was some improvement in the condition of the young animal, but not enough to be biologically significant.

In the experiments, sex gland tissues from pigs were used on some of the animals, tissues from cattle on the others. Healing of the operational incisions was more rapid after the implantation of the pig tissue; otherwise no differences were noted.

The results of the experiments are described in detail in the current number of *The Journal of Agricultural Research*.

RECOGNITION OF WORDS BY DOGS

DOGS learn the meaning of certain words very well and are not fooled by similarly sounding words. Nor

are they fooled by certain other circumstances purposely introduced to confuse them. These facts were brought out by extensive experiments made by Dr. Emanuel Sarris at the Institute for Environmental Research, Hamburg.

Several dogs were used and given such names as Paris, Haris, Aris, Argos, Niki, etc., some of which have very similar sounds, others very different. The dogs learned to respond to their respective names perfectly. They were then taught a few simple words and phrases of importance in the dog world, such as meat, stick, basket, on the chair, under the table, etc. Once having learned these words and phrases, they recognized them under a variety of confusing circumstances by their sound alone, independent of tone of voice or emphasis, and without the help of signs or gestures. They recognized them when mixed with other words, when the speaker and object were out of sight, and whether the voice was male or female.

Thus the dogs being in one room and the experimenter in another, such commands as the following were given: "Come Paris (or Haris, or Aris, etc.), to the meat"; "Come to the meat Paris"; "Paris come to the meat." In each case the appropriate dog did the appropriate thing. Variety of phraseology and similarity of sounds did not confuse them.

Aris was sung to in Greek. In the midst of the poem, one of the words he knows was inserted, but it was sung in the same tone and rhythm as the rest of the poem. Aris recognized it at once and acted accordingly. Later he learned the Greek word for it.

Aris was taken into a room in the institute where he had never been before. "On the chair," commanded his master, without moving a muscle. Aris ran all around the room searching and stopped finally at a chair turned over on its side, looking at it dubiously for a few seconds. Then he jumped on top of it. In a similar way on different occasions he accepted a stool up-side-down, a stool on top of another, a stool under the table, a bench, a settee, three chairs in a row and a chair wrapped up in gray paper.

When commanded, "Under the table," Aris crawled under the typewriter desk, although he had never seen such an object before.

The experiments showed that dogs recognize words by their sound alone, and can pick them out from a confusion of other sounds. They can also pick out from a confused and unfamiliar environment objects corresponding in function to familiar objects.

ITEMS

THERE is no super-heavy element called bohemium. Announcement made last month, when the supposedly new substance was first reported by Dr. O. Koblic, was premature, he now reports to *Nature*. The tiny speck of yellow powder obtained from pitchblende, a common source of radioactive material like radium, was not a new element. It was simply the metal tungsten, declares Dr. Koblic, like that found in the small wires inside electric lights. But the tungsten was in a form not easily identified. For the month that Dr. Koblic's element bohemium was thought to exist, science had to puzzle over two elements both having atomic number 93. As such they were both heavier than any elements recognized in chemical tables which end with uranium, element 92. The second element 93 was that of Dr. Enrico Fermi, Italian physicist from Rome. Now the Italian variety of element 93 stands alone. It is radioactive and disintegrates like radium. But substantiation of Dr. Fermi's work is still unreported by other scientists.

PROFESSOR JELLINEK, French scientist, placed a raw egg between two condenser plates connected to a short wave radio transmitter. The power applied was 1,000 watts, the wave-length 3 meters. After five minutes' exposure the yolk of the egg was found to be cooked hard and solid, but the white was scarcely affected, being only of the consistency of a jelly. Yet the temperature of the yolk at the end of the cooking was only 140 degrees Fahrenheit, while that of the white was 176. This experiment was part of a research on the effect of short radio waves on different organic tissues, which Professor Jellinek recently reported to the Paris Academy of Sciences.

SPECIAL radio receivers at filling stations and other points along motor routes to supply autoists with weather information is suggested by the Bureau of Air Commerce. Every hour 68 airways broadcast stations in the United States send out the latest weather news for the benefit of fliers. This information, often valuable for motorists, could be made available by the installation of 200 to 400 kilocycle receivers at places motorists frequent on a cross-country trip. The plan, it is believed, would be particularly valuable in rugged and mountainous regions where a fog may mean delay, a heavy rain a road washout and snow an impassable section of road.

IT is reported that many fires have been traced to small birds who pick up lighted cigarette butts from the street and, leaving a trail of smoke like a tracer bullet, carry them off to their nests in the eaves of old buildings or warehouses. A report to the Railway Fire Protection Association states that an abandoned theater in Rockwood, Tennessee, was destroyed by a fire originating at a point where sparrows made their nests. As the narrative goes, citizens sitting in the cool of the evening before the town hotel had seen sparrows pick up discarded cigarettes and fly off with them still burning. Fire-chief Johnson, of Knoxville, reported that a locomotive engineer had seen a sparrow pick up a lighted cigarette and fly away with it, leaving a thin wraith of smoke behind him, to the eaves of a near-by dwelling. Several days later when the engineer stopped the train at that town he was surprised to see that the house had been destroyed by fire. Extremely small charges of static electricity have been found also to be one cause of the great toll of fires which cost industry so much each year both in life and property. During the past six years 147 fires have been attributed to this form of electricity. The friction of an endless belt running over pulleys has been observed to generate a spark of two volts potential. In an atmosphere containing a certain amount of inflammable gases this would be sufficient to cause an explosion resulting in a very serious fire.

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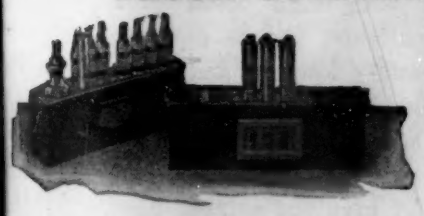

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SCIENCE NEWS

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ADDRESS OF THE PRESIDENT OF THE AMERICAN PUBLIC HEALTH ASSOCIATION

SPEND a little less on alcohol, tea, coffee, tobacco and cosmetics in order to have more to spend on preventing disease and improving human health. Try to raise the general intelligence level. Have the courage to apply what is already known about health and disease, and to search for further knowledge along these lines.

These three pieces of advice were given to health workers of America, Canada and Mexico by Professor Haven Emerson of Columbia University, president of the American Public Health Association, meeting at Pasadena. Professor Emerson addressed the first general session of the organization at Pasadena on September 1.

Self-denial, increased general intelligence and courage are the three elements needed to further improve human health. Specific problems which he urged health workers to concentrate their efforts on are sanitation, diabetes, alcohol, industrial diseases, syphilis and sex and marriage education including birth control.

Referring to the modern frankness of mind, act and speech, he urged that health officers attack the matter of sanitation with equal frankness of spirit and of language. We can not consider ourselves a civilized nation until every place of human habitation is equipped with the means for sanitary disposal of human waste with its infesting and infecting organisms of disease.

The problem of checking the increase in diabetes must be met by teaching people to exercise the large muscles of their bodies more and to limit their intake of food, he believes. He sees the increase of this disease as a result of the machine age which has reduced man's muscular exertion to the use of the fine muscles of eye and finger and has insured, with but slight interruptions, a superabundance of food.

Years can be added to human life expectancy, the birth of wanted children assured and large vacancies can be created in hospitals and asylums when the race is washed clean of the pollution of syphilis. This is the most prevalent of all communicable diseases and one for the prevention of which we are doing the least. Yet practical knowledge of how to combat syphilis exists to a greater degree than for any other disease, except diphtheria, malaria and hookworm infestation. The disease exists in more than a third of the rural population, both Negro and white, of some southern states.

A NEW WEIGHT-REDUCING DRUG

DINITROPHENOL, potent new weight-reducing drug, should be added to the poison list and its sale regulated so that it can be obtained only on a physician's prescription.

This step was urged as a safety measure by Drs. M. L. Tainter, W. C. Cutting and A. B. Stockton, who were the first to report the use of the drug as an obesity remedy, at the meeting of the American Public Health Association.

"Probably at least one hundred thousand persons have been treated with the drug in this country alone," Dr. Tainter stated in reviewing the results obtained with the remedy since he and his colleagues first studied its possibilities in 1931. It has also been used in Canada, Great Britain, France, Sweden, Italy and Australia.

Three deaths have been reported from its use. One was a psychiatric patient and there is some doubt in Dr. Tainter's mind as to whether the drug was the cause of this death. The other two were a physician who took two tremendous doses and a girl who bought the drug on her own responsibility from a druggist and took a very excessive dose. Excessive amounts of the drug cause death by producing a fatally high fever.

A possible means of treating this dangerous fever was suggested by Dr. Tainter, who said that in animals, at least, the fatalities from a fever of dinitrophenol can be prevented by chilling the skin with ice packs and by giving oxygen inhalations.

The main disadvantage to the medical use of the drug is the very alarming and unpleasant skin rash which it sometimes produces. A saving feature is that about half the patients who have had one such skin reaction are able, after a short interval, to continue the treatment without further difficulty.

Dr. Tainter and colleagues were unable to find that the drug, in proper dosage, had any harmful effect on liver, kidneys, blood, digestive tract or blood pressure or circulation. Patients with high blood pressure can be treated like other patients, and as they lose weight the blood pressure is usually lowered and the accompanying symptoms of that condition improved. There is always a possibility that some persons may have an idiosyncrasy for the drug and in these patients harmful effects might be produced by even the correct doses.

Because it is such a potent remedy Dr. Tainter urged not only that its use be limited to physicians but that even doctors should not use it until every other remedy for reducing weight, including careful dieting, had been tried.

BREAST CANCER IN RELATION TO CHILD BEARING AND NURSING

CANCER of the breast is the penalty women pay for failing to bear and particularly to nurse children, in the opinion of Dr. Emil Bogen, of Olive View, Cal. Evidence for this theory, based on statistics and animal experiments, were presented by Dr. Bogen at the meeting of the American Public Health Association.

Comparison of birthrates and of cancer deathrates show that where the birthrate is low, the deathrate from breast cancer is high. Furthermore, in urban localities, northern countries and regions where small families and early weaning of the babies are customary the death rate from breast cancer is high. It also appears to

higher among unmarried women and married women who have not had children than among mothers of large families.

From experiments with white mice, Dr. Bogen finds an explanation for this. A derivative of the chemical substance, cholesterol, is capable of producing cancer just as some of the coal tars do when painted on the skin, he pointed out. This same substance, cholesterol, is present in the ducts of the female breast, both when it is producing milk and when it is not. In the absence of the normal drainage that comes with milk production and child nursing, this cholesterol may undergo the chemical changes that make it develop cancer-producing qualities, Dr. Bogen's opinion.

Child-bearing and nursing is accordingly a natural preventive measure against this cancer-producing agent present in the body.

THE GULF HURRICANE

"SCREWY," though slang, is nevertheless an accurate characterization of the conduct of the Gulf hurricane that threatened the Gulf ports of Texas during the last week in August, and then put out to sea again, bound no one knew whither. Its course could almost be charted with a corkscrew.

It was not in any respect a typical autumnal tropical storm in its coming, and in its howling retreat over the thrashed-up waters of the gulf it was just as atypical, C. L. Mitchell, of the U. S. Weather Bureau, told Science Service. It was driven back, "licked," by a high-altitude land wind from the north.

It was not a large storm, as hurricanes go, but what there was of it was pretty intense. When it approached Galveston, meteorologists expected it to go on ashore, wreak what damage its strength enabled, and then blow itself out over the wide plains of Texas. That is the ordinary, "orthodox" thing for a hurricane to do. People on the gulf coast, warned of its coming, made things as secure as possible and then got out of the way.

Instead of striking as expected, however, it veered back toward the east, whence it had come, and when last heard of it was still doing its dervish dance out over the gulf, some 280 miles to the south of the Mississippi delta.

Meteorologists were as baffled as laymen over this abnormal behavior, until reports of pilot balloons launched at inland points in the South and West began to come in. These showed that a strong north wind at high altitudes had steadily pressed against the westwardly drifting storm from the gulf, amounting in effect to a counter-attack which it could not overcome or pierce, so that in the end there was nothing to do but retreat.

This saving high-level north wind was born of a great, persistent area of high pressure, that moved in with the recent cool wave from the Northwest and had much to do with the beneficial rains that have fallen in the Middle West and Southwest. This "high" constituted a citadel of even, steady weather which the violent but small off-shore storm could not penetrate, and from which the land-wind sortie issued to drive it back.

At last reports, no one was willing to guess what the gulf storm would try next. It might swing to the northeast, threatening the Florida panhandle, it might continue straight east, striking the Florida peninsula, or it might blow itself out over the gulf. It was still intense, but still small in area, so that its damage, wherever it may strike, is expected to be severe in degree but limited in extent.

In its birth no less than in its behavior, the storm was atypical, Mr. Mitchell said. The usual autumnal hurricane comes into being somewhere out over the South Atlantic, drives up through the Caribbean, and makes its landfall somewhere in the West Indies, on the South Atlantic coast of the United States, or on the gulf coast of this country or Mexico.

Not so the present storm. It apparently originated right in the Gulf of Mexico itself, for its presence was first reported somewhere to the southward of the Mississippi delta. Thence it followed its erratic course, first toward the west, then back again in an easterly direction.

This has been a freak season for marine storms in any case, according to Mr. Mitchell. There have been three so far, one in June and two in August, none of them of tropical Atlantic origin. The other August one originated off the Carolina coast and wound up on the shores of Texas.

Two August "tropicals" striking Texas in themselves constitute a record. In forty-eight years of record, only half-a-dozen hurricanes have struck the Texas coast during the month of August. Never before, so far as can be determined, have the weather-gods bestowed upon it such a double doubtful favor.

NEW DETERMINATIONS OF THE AGE OF THE EARTH

BY DR. ALFRED C. LANE
Tufts College

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FROM strife-torn Austria comes new scientific evidence that the age of the earth is not less than 1,725,000,000 years. Thus does the city of Vienna maintain the heritage which has made it a great scientific center in the past.

From correspondence with scientists in Austria I have just learned that while troops roamed the streets outside, investigators at the University of Vienna have completed an analysis of radioactive rocks from near Winnipeg, Canada, which provides the new insight into the age of the earth.

The method of determining the age of rocks and mineral from the amount of radioactive material they contain, and the ratio of such material to the amount of lead present has been frequently described. The process (often referred to as the radioactive "timeclock" method) is in many ways like finding out how long a popcorn machine has been running by determining the proportion of popped to unpopped corn in it.

By analogy, the unpopped corn would be the radioactive material present in the rock which has not, as yet, disintegrated. The popped corn would correspond to

the products of disintegration, principally radioactive lead.

Some time ago, Dr. H. V. Ellsworth, the expert of the Canadian Geological Survey in such matters, analyzed a sample of the mineral uraninite from near Winnipeg, Canada. He found a large proportion of lead present compared with the radioactive element uranium.

The ratio, in fact, was so large that he suspected some of the lead might not be of radioactive origin; or that despite its fresh appearance some uranium might have been removed from the rock during the billion and more years it had remained in its location. Either happening would have produced the surprisingly large ratio of lead to uranium.

During the last few years in the laboratory of Professor A. Franke at Vienna, Dr. F. Hecht and his assistant, Miss Edith Kroupa, have been making a special study of the use of chemical microanalysis. This is simply a method of obtaining an accurate determination of the amounts of materials in a substance when the total amount of sample is very small.

It was believed that the Viennese micro-methods would prove useful in checking the findings of Dr. Ellsworth. Accordingly the Canadian investigator sent to Vienna four tenths of a gram (about a hundredth of an ounce) of monazite which was associated with the uraninite sample. Monazite contains thorium, another radioactive material which ultimately, if given long enough, changes into a form of lead.

Working with this almost microscopic speck of material Miss Kroupa, guided by Dr. Hecht, made the microanalysis. Using their results one can compute that the rock from Winnipeg is beginning to approach two billion years of age. A fair estimate of its antiquity is probably some 1,725,000,000 years. Other data as to the rate of disintegration of thorium into lead might make the result as high as 1,820,000,000 years.

One can not be too fussy about a few million years when a minute error in weighing will produce such a difference. Miss Kroupa's data essentially substantiate the findings for the age of rocks elsewhere in the world. Minerals obtained at Sinyaya Pala in North Carelia, Russia, have been assigned the age of 1,850,000,000 years, for example.

The Viennese work, therefore, makes it highly probable that the Winnipeg minerals are the oldest yet known, at least on the North American continent.

ITEMS

A PICTURE of village life which flourished on Lake Titicaca, 1,200 years ago, including the practise of burying the dead under the houses, is brought by Dr. Wendell C. Bennett, who has just returned from archeological explorations in the high plateau of Bolivia, for the American Museum of Natural History. The houses of the village had completely encircled a mound beside the lake, Dr. Bennett found. The stone houses of the Incas are fairly common, but these houses were the rare relics of adobe and small stones, built by earlier people. Under the floor of one house were found 12 tombs, containing skeletons of children and adults.

Homo soloensis, a prehistoric race that lived in Java 40,000 years or more ago, had tools and weapons resembling those of Neanderthal Man in Europe. This is the conclusion of Dr. P. V. van Stein Callenfels, based on a study of a large collection of such implements of stone, bone and horn collected on a terrace of the River Solo. This terrace was apparently formed during Pleistocene or Ice Age times. The animal bones found associated with the relics of human occupation included an extinct elephant, a hippopotamus and other animals no longer known in Java.

ELEPHANT bones, apparently of Ice Age date, have been discovered during the digging of a well in a garden at Bethlehem. This is the first time such remains have been found in either Palestine or Syria, so that scientists are interested in tracing their possible connection with the "African" type of animal remains found in Palestinian caves in association with prehistoric human remains and stone implements. The find has been reported to *Nature* by Miss Dorothea M. A. Bate. A more detailed account, giving full description of the remains, is to be published shortly.

SMALL quantities of air can now be measured with great accuracy. Of particular use in air-conditioning of houses a small machine has been invented that can determine in a very short time if a sheathing paper meets requirements as to the amount of air that can leak in or out through it. S. T. Carson, of the National Bureau of Standards, who developed the instrument, has found that it has a range about a thousand times greater than most similar devices for measuring permeability. It can be used on leather and insulating materials as well as such thin membranes as a cigarette paper. Paper sheathing, air-tight food wrappers, grease absorbers and the insulation for electric cables can all be studied and their true value found. Since air permeability is related to liquid absorption the efficiency of roofing materials and the rate of drying of ink on printing paper can also be measured accurately.

WHEN lightning strikes a lightning rod or the steel mast of a high tension line, it may produce a current as high as 60,000 amperes, enough to light 130,000 fifty watt lamps all at once. This is the result of a research carried on since 1926 by Dr. Heinrich Greunewald and his associates, of the Berlin-Charlottenburg Society for the Study of High Tension Installations. Currents of 30,000 amperes in lightning were found to be frequent, 50,000 to occur occasionally, and 60,000 was the highest measured. The investigation was made by inserting in the path of the lightning short rods of a special substance that becomes magnetized on the passage of a current. The degree of magnetization showed the strength of the current, and the polarity of the magnetism showed its direction. It was found that the current usually passes upward from the ground instead of downward as commonly supposed, showing that the base of a thunder cloud is usually negatively charged. This is in accord with the results of other recent investigations.

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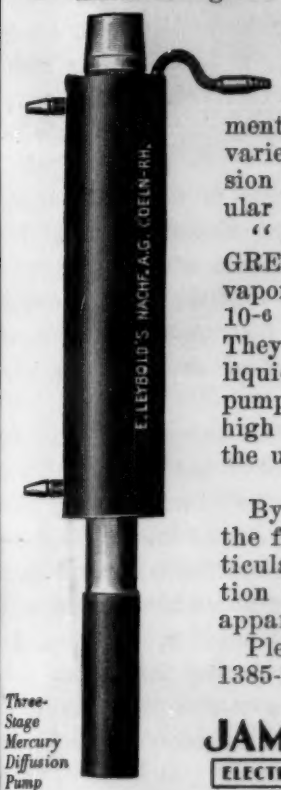

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SCIENCE NEWS

Science Service, Washington, D. C.

SYNTHETIC VITAMIN C

SYNTHETIC vitamin C, called ascorbic acid, in its first actual use on medical patients is producing very striking and unexpected disease conquests, the British Association for the Advancement of Science meeting at Aberdeen was informed by Professor A. Szent-Györgyi, the Hungarian chemist who played a major rôle in the artificial manufacture of this important vitamin.

A certain kind of hemophilia, the mouth disorder known as pyorrhea, certain forms of hemorrhagic nephritis and several other diseases against which medicine was helpless are seemingly being cured by ascorbic acid. Ascorbic acid is not a cure for hereditary hemophilia.

"This is the more striking since these pathological conditions have not been thought to be connected with lack of vitamin," Professor Szent-Györgyi explained. "These curative effects suggest that humanity is suffering much more gravely from a lack of vitamin C than has hitherto been supposed." Disfiguring colorations of the skin brought on by illness are also made to disappear by ascorbic acid. Patients with Addison's disease, who have a yellow color, can be bleached out again by the use of this substance.

The complete exploration of the mysterious vitamin C, found most abundantly in citrus fruit, was one of the most fast-moving dramas in current science. In the short space of two years vitamin C has been identified, its chemical structure determined and it has been made synthetically in the laboratory. The pure, highly concentrated vitamin C acid has been made available for industry and medicine.

Hungary, represented by Professor Szent-Györgyi, who is director of Szeged University's Institute of Medical Chemistry, Switzerland, England and other countries have worked together in this great chemical conquest. "It is pleasant to note that this unparalleled advance is due entirely to the closest and friendliest international collaboration," Professor Szent-Györgyi said.

It is predicted that the rôle of ascorbic acid in life may be even more important than is now realized, for there seems to be no cell life in higher organisms without ascorbic acid.

Vitamin D, the sunshine vitamin present in liver oil and green vegetables, was called the salvation of teeth by Dr. May Mellanby, of the British Medical Research Council. It helps to prevent and arrest dental decay or caries even in imperfect teeth. Beautiful teeth are found in Eskimos who get their vitamin D from blubber and in natives of the tropics who get theirs through exposure of naked bodies to the ultra-violet rays of the sun.

THUNDERSTORMS SHATTER RADIO "MIRRORS"

THUNDERSTORMS shatter the radio "mirrors" of electrical particles hundreds of miles above the earth and bring "bad luck" to radio listeners in the form of poor reception. This, in substance, is the report of J. A. Ratcliffe, of the Cavendish Laboratory of the University of Cambridge, before the British Association.

The radio "mirrors," which reflect radio waves and make possible transmission over long distances, are in the ionosphere. Each mirror is a layer of air atoms split apart and in this way electrified. Radio waves bounce off the under side of these layers and are reflected back to earth.

Mr. Ratcliffe used radio signals to study the height of such reflecting layers during thunderstorms. The method is essentially an "echo" one and similar to the system of determining the depths of the ocean by sending sound waves and waiting for the echo. The one difference is that radio instead of sound waves were employed.

It was found that one electrical layer, designated by the symbol E, was 78 miles above the earth before a thunderstorm arrived. During the storm the electrical discharge pushed the layer down to 65 miles. With the cessation of the storm the height of the layer rose again to 78 miles, but within fifteen minutes it mounted to 93 miles. The electrical reflecting surface, therefore, undergoes great oscillatory motion during the storm.

Because of the up and down motion the fidelity of radio reception varies during the thunderstorm just as a beam of light reflected from a still pool is greatly different from that reflected by the water in the pool when waves are stirred up in it.

DYSENTERY AND NATIONAL HEALTH

AMEBIC dysentery continues to threaten the health of the American people, in the opinion of Dr. F. W. O'Connor, of Columbia University, who pointed out the importance of tropical diseases in the United States at the meeting of the American Public Health Association in Pasadena.

In the future greater attention should be paid to the question of amebic dysentery because the usual number of carriers of the parasite in this country has doubtless been augmented by a number of persons in different parts of the states who became carriers as the result of the Chicago outbreak but did not develop symptoms.

From six to twelve million persons in the United States are subjects of this disease, according to an estimate made by Dr. Alfred C. Reed, of the University of California Medical School.

The danger from carriers of amebic dysentery is twofold, Dr. O'Connor pointed out. Not only are they probably spreading the disease to others who may become seriously ill, but the carriers themselves may at any time develop the disease in malignant form. Development of liver abscess as a result of amebic dysentery infection is a particularly grave complication which threatens the so-called healthy carrier and the apparently cured case. Dr. O'Connor emphasized the danger of relapse in patients who had been treated and apparently had been cured of the disease. The recent epidemic in Chicago shows that the very progress of mankind may not only

bring new evils in its train, but may upset the biological balance between parasite and man.

The Chicago epidemic was traced to sewage contamination of drinking water in two hotels as a result of faulty plumbing. But such conditions probably exist in other cities. Outbreaks of amebic dysentery as severe as the one in Chicago last year may occur in other parts of the country at any time, especially under conditions of guest strain such as large conventions bring.

THE DISEASES OF MIDDLE LIFE

MAN'S chance for long life now depends on the conquest of diseases of middle life, namely cancer, diabetes and the diseases affecting the heart, blood vessels and kidneys, according to Dr. Louis I. Dublin, of the Metropolitan Life Insurance Company, speaking before the American Public Health Association at Pasadena.

No headway has been made in the fight against these diseases since 1920, Dr. Dublin said. In fact, among persons of advanced age, almost twice as many deaths in a unit of population are attributed to these diseases to-day as in the early years of the century. The increase in deaths from these diseases is only in part due to better diagnosis and reporting of the ailments. Some of the increase is an actual one.

About six hundred thousand fewer people die every year at present than would if the health conditions of 1900 still prevailed, Dr. Dublin pointed out. For every thousand of the population, five more survive under present conditions who would have died under the old régime. But this improvement has been achieved almost entirely among persons under 45 years of age and more particularly among infants and children.

Increased control over tuberculosis, pneumonia, typhoid fever, diphtheria, scarlet fever and, more lately, measles and whooping cough has been a big factor in adding eleven years to the expectation of life at birth and even as many as four years to the expectation at the age of twenty years.

ANTHRAX AND GASOLINE POISONING

ANTHRAX is definitely on the increase among agricultural workers in this country and is a definite menace in the wool industry in several manufacturing areas, Dr. Henry F. Smyth, of the University of Pennsylvania, reported to the American Public Health Association. The death rate for this disease, except in a few states, shows no tendency to decline, the committee, of which Dr. Smyth is chairman, found in studying the anthrax situation during the past five years. The best method of treating the disease is by large doses of anti-anthrax serum applied locally and injected into the veins. This treatment must be kept up until definite improvement is evident.

The increasing numbers of deaths from this disease are due in part to its increase among agricultural workers where the serum is not available. Wool and wool clothing are frequently sources of this infection. Machinery in a textile mill may become infected and transmit the infection to subsequent materials. A distinct hazard of both acute and chronic poisoning from gasoline and benzine exists in the petroleum industry, Dr. Smyth reported. These substances act as narcotic poisons and produce injuries to the nerves in chronic cases.

Treatment with calcium, the substance which gives bones their hardness, is the "sheet anchor" in cases of carbon tetrachloride poisoning, the committee found on investigation of this industrial hazard. Carbon tetrachloride is the chief ingredient of many cleaning solutions.

However, because it is used as one of several ingredients in certain mixtures, in the opinion of the committee, it has often been unjustly blamed for causing harm when some of the other ingredients in the mixture have probably been the real cause of the poisoning.

VARIATIONS IN PITCH OF THE VOICE

OPERATIC and concert singers, even the most noted artists, habitually sing off pitch, according to Dr. Harold G. Seashore, Eastman fellow in psychology of music at the State University of Iowa, at the meeting in New York City of the American Psychological Association.

Such variations from the true pitch of a song are probably unconscious on the part of the singer, Dr. Seashore indicated, although they may not be errors, either. Certainly the listener hears the performance as correct and artistic; the variations are not detected by the ear. In fact, Dr. Seashore considers it probable that if the singer were to sing rigidly in true pitch, his performance would be considered thin, mechanical and lacking in feeling.

The singers studied included such well-known concert and operatic artists as Richard Crooks, Louise Homer and Lawrence Tibbett, as well as two college voice instructors. The songs were in legato style and varied in difficulty from "All Through the Night" to two Handel arias. The voices were recorded by means of a sound photographing device called the strobophotograph which recorded graphically each variation in pitch and intensity, however minute.

The photographic records showed that what is heard as a single note when sung by the artist is really a vibrato or oscillation between two pitches which may be as much as eight tenths of a musical step apart. From 78 to 85 per cent. of all tones are off-pitch part of the time, with an average deviation of one tenth of a step.

"Apparently singers to a degree 'hunt' for the correct pitch and interval extent," Dr. Seashore said. He concluded, however, that the errors found are not due to motor skill deficiency or to auditory misjudgment, but are deviations necessary for the legato flow of the song.

Gliding attacks, or the sliding up to the note sung, were found to be more common than musicians are willing to admit. "Gliding attacks are universally condemned although we can now demonstrate that all good singers sing many tones with a rising pitch glide, sometimes as great as several whole tones," Dr. Seashore said. With Miss Homer, 13 per cent., and with Mr. Crooks, 33 per cent. of all the tones in the songs were begun with rising pitch glide. Falling gliding attack was found to be rare.

ITEMS

IN the future, the investigator experimenting with anthropoid apes may have his laboratory material standardized. This is the prophecy made to the American Psychological Association by Dr. Robert M. Yerkes, of the Yale Laboratories of Comparative Psychobiology. It will require years to achieve this ideal, but ultimately the investigator who wishes to study the behavior or physiological reactions of these apes may select a subject accompanied by a pedigree, life-history and characterization. This is one of the primary objectives of the breeding colony maintained by Yale under the direction of Dr. Yerkes. On May 1, 1934, the breeding colony consisted of three mature male chimpanzees, twelve mature females, four children and ten infants under three years. Between May 14, 1933, and May 2, 1934, eight normal births occurred at the station.

LEARNING can take place, to a limited extent at least, when the brain cortex is completely missing. Cases of dogs who had lost their brain cortex through injury to the brain and yet could be "conditioned" or taught to modify their behavior, were reported by Dr. Elmer Culler, of the University of Illinois. When a bell is rung or a light is flashed at the same time that a healthy animal is given an electric shock, he will soon learn to pull back his paw as soon as the bell or light signal is given and thus avoid the shock. The animal who has lost the brain cortex can not learn to avoid the shock, but he does learn to show general symptoms of annoyance at the signal alone. This shows that he does make a connection between the signal and the shock.

THE case of a child who at two years had the mental age of an infant of less than seven months, or an intelligence quotient of only 28, but who while being fed pituitary gland extract gained in mental ability until at five and a half years it equalled children nearly six years old and had an I.Q. of 103, was reported by Dr. Florence Mateer, director of the Merryheart Schools, Columbus, Ohio. For 34 children under treatment at Merryheart for diseased pituitary glands, the gain under pituitary feeding has been from 5 to 22 points in intelligence quotient in a year, the gain continuing throughout the period of study.

YOU feel a flatiron as hot or a piece of ice as cold not because of the action of a special temperature mechanism in the skin but through the action of your blood vessels. The heat dilates or enlarges your blood vessels, while cold, on the other hand, contracts them. This theory, opposed to the commonly held one of a special skin mechanism for feeling temperature, was proposed by Dr. John P. Nafe, of Washington University, St. Louis, Mo. The cornea of the eye, which contains no blood vessels, can not feel temperatures, Dr. Nafe reported. The fact that warmth is perceived gently as a gradual flowing in while cold seems sharp and quick also points to the origin of the sensation in the blood vessels, he believes. When you place your left hand in cold water, the blood vessels in your right hand also contract and within three seconds your right hand becomes more sensitive to heat and less sensitive to cold.

SALT is not a taste. Evidence that this common food ingredient is not tasted but rather felt by some special skin mechanism was presented by Dr. Samuel Renshaw, of the Ohio State University. Thus the four traditional primary tastes—sweet, salt, sour and bitter—are probably now narrowed to three. At a neutral temperature of about body warmth, tastes diminish. Salt, however, does not follow this rule: it is noticed more in lukewarm foods than in hot dishes. Also it can be noticed on the lips and gums of the mouth where there are no taste organs.

PICTURES of how atoms of helium, neon and argon would look if scientists could really see them are presented by Dr. E. O. Wollan and Professor Arthur H. Compton, of the University of Chicago, in the *Journal* of the Optical Society of America. The atom photographs, for they may be called such because they are made by one form of photography, look like the moon with a ring around it. The rings are the swarms of electrons flying around the atom's central core. X-rays were used in taking the atom pictures. When the rays are passed through helium gas a characteristic pattern of scattering occurs. The trick of photographing atoms was to study the distribution of the x-ray scattering and then make a paper pattern, or template, which would reflect visible light just as the atoms scattered the x-rays. Such atom patterns were made for each of the gases studied. When cut in the proper shape the patterns were rotated and allowed to reflect light. A photograph of the reflected light produced an image on a photographic plate similar in appearance to the atom studied, except that it was some 100,000,000 times larger.

ONE of the less-known experiments performed by the Japanese scientists during the total eclipse of the sun in the Pacific Ocean last February was to determine if the cutting off of the sun's rays by the moon would change the magnetic field of the earth. Commander Akiyosi, of the Japanese Naval Hydrographic Office, found such an effect, according to a report by Dr. Josef J. Johnson, of the California Institute of Technology, who was one of two Americans accompanying the expedition to the Pacific. Dr. Johnson describes the experiment in *Popular Astronomy*.

THE wholesale slaughter of all wild mammals except deer over an area of 192,000 acres in Maine, will lose at least a part of its element of tragedy in becoming a study of the preservation of bird life. When foxes in the southwestern part of the state developed rabies, the only way seen by the U. S. Bureau of Biological Survey to prevent a wide-spread epidemic was to kill off all animals in the area that could possibly become infected. The fact that a great many of the doomed animals are those who by nature prey on bird life gives the bureau an opportunity to study the effect that complete extermination of natural foes will have on the game and song birds of the region. In the war against such animals as woodchucks, porcupines, squirrels, hares, bobcats, bears, skunks and foxes, cyanide gas is being used, in addition to the conventional traps.

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The Problem of Mental Disorder

A study undertaken by The Committee on Psychiatric Investigations, National Research Council, and supported by a grant from The Carnegie Corporation. Members of the Committee: MADISON BENTLEY, Chairman, Cornell University; and E. V. COWDRY, Washington University. 390 pages, 6 x 9. $4.00

This candid appraisal of concepts, methods, and principles aims to (1) state the problem in its various phases; (2) present the views of representative psychiatrists; (3) interrogate the biological and psychological sciences to discover methods and products of research which may be applied toward a better understanding of the problem; and (4) summarize and interpret the material collected.

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SCIENCE NEWS

Science Service, Washington, D. C.

PAPERS AT THE CLEVELAND MEETING OF THE AMERICAN CHEMICAL SOCIETY

By ROBERT D. POTTER
Science Service Chemistry Writer

ISOLATION of the heavy element proactinium has been achieved, according to an announcement made by Dr. Aristid Von Grosse, assistant professor of chemistry, University of Chicago, to the American Chemical Society meeting at Cleveland. Dr. Von Grosse stated that proactinium is the first chemical element to be isolated in the United States, although several elements, including illinium, alabamine and virginium, have been discovered here. The newly isolated proactinium is next to the heaviest element known, which is uranium with atomic number 92. Proactinium is number 91 and its atoms weigh 231 times as much as those of ordinary hydrogen. It is radioactive and continually breaks down like uranium and radium. Proactinium's half period, or the length of time it disintegrates to half the original amount, is 32,000 years. Radium is much shorter lived, having a half period of only 1,600 years. Of importance to scientists everywhere is the possibility that the famous super-heavy element number 93 of Professor Enrico Fermi, may be an isotope of proactinium. Personally, Dr. Von Grosse said, that he believed this to be the case and has so written to Professor Fermi. The work of isolating proactinium was begun three years ago, when three tons of radium residues were imported from the world's oldest radium factory at Joachimstal, Czechoslovakia. From a ton of these residues and at a cost of $5,000, Dr. Von Grosse obtained one tenth gram of proactinium in its pure form. A tiny sample of the rare substance was exhibited to the society. It is a thin coating of proactinium on tungsten wire and sealed in a glass bulb. A magnifying glass is needed to see it. Dr. Von Grosse, who is 29 years old, was born in Riga, Russia, and brought up in Shanghai, where his father was Russian Consul. He was educated in Berlin at the Institute of Technology, where he won the degree of doctor of chemical engineering in 1927.

A NEW tool for determining extremely minute amounts of chemical elements in microanalysis, using radioactive disintegration, was described by Dr. Charles Rosenblum, of the department of chemistry at the University of Minnesota. The new technique was acclaimed by the chemists gathered in Cleveland as having almost infinite possibilities in the chemical detection of amounts of material too small to be determined by the finest present-day chemical means. Describing his method, Dr. Rosenblum pointed out that many of the heavier elements have radioactive isotopes—twin forms which are chemically indistinguishable but which make known their presence by breaking down. Such isotopes liberate alpha, beta or gamma rays, just as the radioactive element radium does. All these rays can be detected by the methods of physics; hence the new microanalysis is a combination of chemistry and physics. The trick in the new method is to add to a solution of some element a small amount of a radioactive element with which it is isotopic. This mixture is chemically inseparable. Yet the amount of radioactive disintegration detectable is a measure of the concentration of the inert element. "If now a certain fraction, say half, of the inert element is removed from the solution by precipitation or electrodeposition," according to Dr. Rosenblum, "the same portion of the radioactive element is simultaneously removed. The radioelement therefore acts as an indicator of the inactive element." The usefulness of the method is not confined to the analysis of the heaviest elements. A determination of sodium sulfate concentration in very small amounts was possible. Using the method of radioactive indicators, the lessening concentration was traced both by radiometric and analytical measurements, but the former could do everything the orthodox methods did and much more. As another example, Dr. Rosenblum traced the solubility of lead sulfate in an alcohol-water solution. Dr. C. J. Brockman, associate professor, University of Georgia, chairman and organizer of the symposium on chemical indicators before which Dr. Rosenblum's paper was presented, said, "Dr. Rosenblum's method is a most powerful tool for the science of microchemical analysis. It is so much more sensitive than our common methods that I believe the possibilities for the future in this field are almost infinite."

A SUGGESTION that the changing enzyme content of various organs of the body during the development of a cancer tumor may represent defensive mechanisms of the body to prevent further malignant growth was advanced by Dr. E. F. Schroeder and Dr. Ellice McDonald, of the cancer research laboratories of the University of Pennsylvania. Future treatment of cancer may be directed toward methods of artificially stimulating the enzyme activity of an organ in order to aid this apparently natural defensive mechanism of the body. Speaking before the symposium on the chemistry of enzymes, the recent work carried out at the university on analyzing the enzyme content of cancer tumors and such organs of the body as the kidneys and liver was traced. Enzymes are the biological chemical catalysts which make possible chemical reactions without entering into the reactions themselves. The enzyme arginase occurs in large amounts in cancer tissue and appears to be closely associated with rapid growth processes like those found in necrotic tumors. The arginase content of other rapidly-growing tissues, like those of an embryo, also contain arginase and as growth slows down the arginase content decreases. In studies on rats given cancer by implantation, it was found that the faster a tumor grows, the more necrotic or degenerated it becomes and the higher grows its arginase content. At the same time the arginase normally present in the liver decreases as the tumor grows. For two other enzymes, cathepsin and phosphatase, the action works in a reverse sense. Their

content in a tumor diminishes as the cancerous growth becomes more necrotic. Phosphatase in particular seemed to be found in high concentration in the kidneys in rats resistant to cancer. The work suggests two pictures of enzyme cancer mechanism according to Dr. McDonald. In concluding the address he said: "The interesting question is raised as to whether these enzyme changes may not be related to a specific immunological reaction against the growth of cancer. For example, the high kidney phosphatase of resistant rats might act as a defensive mechanism against further growth of the tumor. Or, from another point of view, the implanted cancer tissue might liberate into the blood stream certain enzyme activators, or stimuli, which would cause other organs to respond by setting up a defensive mechanism in the form of increased enzyme activity. If the stimulus is sufficient the animal may throw off the cancer; if not, the cancer grows. This opens an interesting field in the possibility of artificially stimulating enzyme activity of an organ as a defense against further growth of the cancer."

NEW investigations in hypnotic drugs producing a degree of insensibility between normal sleep and complete surgical anesthesia were reported by Drs. E. H. Volwiler and D. L. Tabern, of the Abbott Laboratories, Chicago. Previous work with derivatives of barbituric acid has produced drugs of the neobutal type, now widely used in hospitals for patients before an operation and prior to the administration of a total anesthetic. Such drugs, when given by mouth in proper doses, produce a relaxed condition in the patient, without causing complete insensibility. While under their influence the patient could be given ether or other anesthetics, and could cooperate with the physician in the process. The desired insensibility came quickly and lasted only a little longer than the operative period; hence decreased possibilities of postoperative complications. Another major improvement in the barbiturate drugs was to increase the margin of safety between an effective dose causing insensibility and a fatal dose. Drs. Volwiler and Tabern observed that these specific effects of the barbiturates were associated with a certain arrangement of the atom groups within the molecules of the compounds. They determined to study the properties of other substances into which these groups might be incorporated. Substituted acetyl ureas, acetamides and brom analogs were employed. In all, twenty-seven different drugs were prepared. Some of these new preparations had unusually wide margins of safety. However, while their study may aid in increasing the knowledge of what factors are needed to raise the safety margin in hypnotic drugs, it is believed that the newest compounds described are not yet ready for clinical application.

A NEW means of speeding up tests by which tuberculosis may be determined was presented by Russell N. Loomie and Dr. Emil Bogen, of Olive View Sanatarium, Olive View, Calif. They pointed out that the remarkable light element, beryllium, possesses toxic properties not suggested by its chemical relationships. Their studies show that beryllium markedly accelerates the development of tuberculosis lesions in infected guinea-pigs. One way of detecting tuberculosis in man is to inject suspected sputum or other materials into guinea-pigs and await the development of tuberculosis in them. One hundredth of a gram of beryllium chloride injected weekly into guinea-pigs usually doubled the extent of tuberculosis found on dissecting the animals at death. Out of all the chemical elements obtainable for the work and after tests on thousands of guinea-pigs, beryllium was the only element which had this action. Tests showed beryllium did not affect the growth of the tubercle bacilli, nor was it found to increase the virulence of avirulent strains of tubercle bacilli such as BCG. It appears, however, to weaken guinea-pigs' resistance to the attack of the bacilli.

ONE of the strangest Jekyl-and-Hyde rôles among the atoms was reported by Dr. Walter H. Hartung, of the Sharp and Dohme Chemical Company of Philadelphia. The multi-faced substance is known chemically as propiophenone. Chemists know accurately its composition, or atomic "skeleton." It is a chemical having a pleasing odor that lends itself to blended perfumes. But by changing the kind of atom "flesh" through chemical manipulation, it is possible to produce thirteen different compounds, all active physiologically and representing seven different types of activity. From propiophenone two kinds of local anesthetics can be built up: a flavor suggesting licorice, a germicide eight times as powerful as carbolic acid, a chemical causing crying, and the stimulant ephedrine. Propiophenone rivals other organic chemicals reported which, while having the same basic atom skeleton, are found in such widely different things as cholesterol, vitamin D, the bile acids, the sex hormones and cancer-producing coal tar products. "While there is abundant evidence of relationship between physiological action and chemical constitution," according to Dr. Hartung, "our knowledge thereof is yet so elemental that we can not even yet vault the low hurdle raised by the chemical family descended from a simple substance like propiophenone."

THE "hot spot" of the world, so far as science can create it, is the carbon electric arc. Such arc lights, used in powerful searchlights, have a temperature of 3,810 degrees above absolute zero. This temperature is exceeded only in distant stars and in the center of the earth. The temperature of carbon arcs, after intensive research which began in 1801 with the work of Sir Humphrey Davy has been determined definitely. To have fixed the temperature as 3,810 degrees is an important landmark for science. Dr. V. C. Hamister, N. K. Chaney and S. W. Glass, of the National Carbon Company, indicated that the new-found temperature will be as important to the science of high temperatures as is the melting point of ice or the boiling point of water to investigators in ordinary temperature work. Uses of carbon arcs include: production of two billion candlepower beam for airway beacons, army and navy searchlights, light for motion picture projection and ultra-

violet light for irradiation of foods and milk to increase their vitamin D content.

As the wood of trees becomes really old—say about a million years, its cellulose content, which marks its youth, decreases while the proportion of lignin, telltale of old age, increases. This is shown in a study of chemical changes in glacial and pre-glacial trees by W. A. Gortner, of the University of Minnesota, one of the few undergraduate students on the highly technical program. Embedded in clay taken from a well ninety feet deep on what was once the site of the great glacial Lake Agassiz, Mr. Gortner found wood fibers buried during the five glacial invasions of ice which swept over the North American continent from 1,000,000 to 25,000 years ago. An examination showed that once vast forests of spruce spread over the region. Through the ages each forest in turn was covered by ice and glacial drift. Basing his experiments on the assumption that spruce wood to-day is like the spruce of a million years ago, Mr. Gortner, under the direction of Dr. S. I. Aronovsky, Dr. C. O. Rosendahl and Dr. R. A. Gortner, his father, made a chemical analysis of the various tree fibers. Cellulose decreased, he found, from 61 per cent. in modern spruce to six tenths of one per cent. in the oldest pre-glacial trees. Lignin, on the contrary, increased from its normal value of 30 per cent. to about 65 per cent. Cellulose, in effect, is what makes wood young. Mr. Gortner's paper is to receive the prize for undergraduate research offered by the Minnesota University Chapter of Sigma Xi.

The best lubricants allow motion between two pieces of metal when they act in the fashion of a small boy skating on ice. To reduce friction under conditions of high temperature and pressure a good lubricant should be a solid; but such a solid that it turns to a liquid when under a load. Dr. Robert C. Williams, of the Ironsides Company, reported that where high pressure and extreme temperatures occur the best lubricants are not the conveniently paste-like greases but solid wax-like materials. Such lubricants act very much as ice does under the runner of a skate; they turn to a liquid and then back to the solid form. Dr. Williams pointed out that one really skates on a film of water formed by the pressure of a skate runner. The water turns back to solid ice as soon as the pressure is removed. The physical properties of lubricants should be: (1) They should adhere firmly to at least one of the two surfaces between which the rubbing occurs; (2) they should remain in a solid form prior to the motion of the two parts; (3) they should turn quickly to a mobile liquid as soon as sliding under load occurs.

THE toxic, poisonous agent in poison ivy that makes it a scourge to picnickers and campers has at last been identified, according to Professor G. Albert Hill, of Wesleyan University. The harmful chemical in poison ivy that does the damage is called urushiol. It had been isolated years previously by the Japanese chemist Majima from Japanese lac. Some persons were poisoned by Japanese lac on Mah Jong sets imported during the "craze" several years ago. Professor Hill used 800 tons of poison ivy leaves in an effort to learn what the toxic agent was, but without success because of its complexity. Success came when the bark of the plant was used as the source of the poisonous urushiol.

DRS. C. D. LOWRY, JR., C. G. Dwyer, Gustav Egloff and J. C. Morrell, of the Universal Oil Products Company, reported that it is possible to use certain dyes as inhibitors for decreasing gasoline deterioration. With age the gasoline "guardians" weaken but at the same time their color fades. Thus chemists are able to tell when the inhibitory chemicals are so weak that they must be replaced.

ITEMS

AT 12:46 P. M., eastern standard time, on Sunday, September 23, the sun will be directly over the equator in its southward journey among the stars. This event, called the autumnal equinox, is taken by astronomical convention as the beginning of autumn. Because the sun is over the equator, it will rise directly in the east, and set directly in the west, so that it will be above the horizon just as long as it is below. Astronomers place no credence in the popular belief in a "line storm" occurring when the sun thus crosses the "line." September is apt to be a stormy month, but bad weather is no more likely to occur on September 23 than on the days before or after.

THE drought of 1934 is at last in full retreat; even the U. S. Weather Bureau has acknowledged the defeat of its late enemy, after a survey of another week's strong rains throughout most of the great central valley. In fact, in some places in Ohio the seeding of the winter wheat crop has been delayed by an excess of rain. Nevertheless, the mischief done by the long drought is far from being repaired, even when the last summer's crop losses are written off the books. Over large parts of the West the reserve of subsoil water is still far below normal. A winter of heavy snows would be one of the greatest benefits the western grain areas could receive.

RUSSIAN thistles, ordinarily regarded throughout the West as a nuisance of a tumbleweed, will yield hay or silage serviceable enough for emergency purposes, according to Professor F. W. Christensen, specialist in animal nutrition at the North Dakota Experiment Station. To be useful for feed, the thistles must be cut while they are in bloom, before the sharp, troublesome spines form and harden. The thistles must be regarded as an emergency ration only, not as a substitute for the regular cultivated hay or silage plants.

WAR against chinch-bugs must be waged on a wider front and more intensively in 1935 than it was last summer, unless severe weather in fall and winter decimates the hordes of the pests now settling into winter quarters in weedy fence-corners and along grassy roadsides. A survey of the situation by the Bureau of Entomology, U. S. Department of Agriculture, gives indication that Iowa will have an especially severe chinch-bug problem to cope with next year. Normally, only the southern fringe of that state is invaded by the insects, but during the past summer they got well up into the central counties; and the territory they have gained will serve for next summer's "jump-off."

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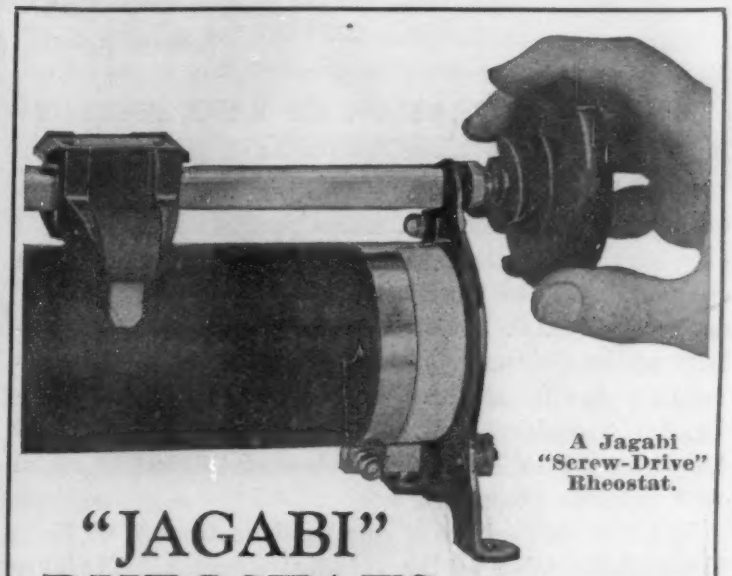

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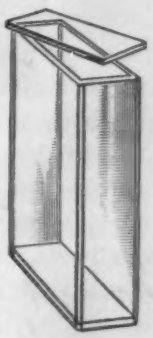

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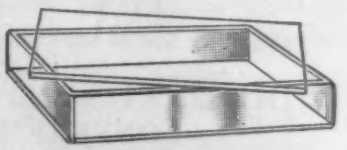

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SCIENCE NEWS

Science Service, Washington, D. C.

THE CONCENTRATION OF RARE EARTHS BY ELECTROLYSIS

A NEW method for concentrating many of the so-called rare earth elements, whose purification has baffled chemistry for years, was presented to the meeting in New York City of the Electrochemical Society.

Professor B. S. Hopkins, of the department of chemistry of the University of Illinois, told of his new experiments with salts of the rare earths in collaboration with Dr. L. F. Audrieth. Professor Hopkins is famous for his discovery in 1926 of the element illinium, a metal with valuable properties.

The rare earths have atomic numbers from 57 to 71 in the periodic table of the chemical elements. They are seldom shown on the familiar classroom charts because they unduly complicate the classification of the elements in a systematic arrangement.

Minerals containing the rare earths occur chiefly in Scandinavia, the Urals, America, Brazil, India and Australia. Owing to the extraordinary chemical similarity of the members of the rare earths and to the further fact that they are associated in nature, it is very difficult to separate them and to prepare them in the pure state. Professor Hopkins's report to the society describes a new method for solving this problem, at least in part.

The first stage in the concentration of rare earth is to mix them with mercury for which they have a great affinity. Mercury amalgams of the rare elements are thus obtained. The preparation of mercury amalgams is not the easy process used by dentists in making silver amalgams for dental fillings. It is necessary to use electrochemical processes where the conducting solution is mercury chloride. Rare earth amalgams prepared electrochemically are liquid or pasty masses containing from one half to three per cent. of the rare earth metal by weight. The amalgams are easily decomposed by exposure to air and moisture. They must be preserved in a vacuum or in an inert atmosphere like neon, argon or helium. Dr. Hopkins states that the amalgams may serve as the starting point for the preparation of the corresponding rare earth metals.

THE INTERNATIONAL STEAM TABLE CONFERENCE

RESEARCH in pure science on the properties of steam is, at last, catching up with the advances made in the improvements in steam power plants and generating turbines. This situation is, in many ways, the exact reverse of the condition found elsewhere in science, where the popular cry is for a moratorium on research until the world catches up with scientific discovery.

With what success science is "catching up" was disclosed at the third International Steam Table Conference in session at the National Bureau of Standards. Investigators gathered in Washington from the United States, England and Germany planned to visit the Massachusetts Institute of Technology and New York City for the concluding sessions of the conference.

Steam tables are lengthy compilations of steam's properties expressed in columns of figures showing the variation of steam's temperature with pressure and countless other data. It is from steam tables that engineers compute estimates of temperatures and efficiencies of power generating units before a hand is turned to construct them. A great million-dollar steam power plant is built for maximum efficiency on the basis of steam tables.

From 1910 to 1930 the development of steam generators, super-heaters and turbines outstripped knowledge of the properties of steam. Steam engineering, in a word, was shooting in the dark and achieving results by the trial and error method.

In 1921 the American Society of Mechanical Engineers began the movement for more experimental work on steam's properties. At London in 1929, in Berlin in 1930 and now in the United States various investigators who have been collecting and extending the data on the properties of steam have gathered to report progress, coordinate data and discuss future research.

At the Bureau of Standards work has progressed on a study of the properties of saturated steam from the freezing point of water to 704 degrees Fahrenheit and from pressures of a fraction of a pound to 3,200 pounds to the square inch. The bureau's work is in excellent agreement with that done elsewhere.

This extensive research has brought into agreement the steam tables used throughout the world. It is now possible to build a turbine in one country and have it pass efficiency tests in another. Formerly the different steam tables in use often led to completely different results on the supposed efficiency of a steam power unit. One aim of the conference is to produce a steam table which will be agreed upon internationally.

A NEW STREET CAR

A NEW street car representing four years of research and a million dollars in cost was exhibited in Cleveland on September 24. The car is a street car rider's "dream" of the millennium. Every remedial annoyance incidental to transport by urban electric car has been removed from the new development.

Forced ventilation is supplied, the seats all face forward and are of the familiar motor bus type; deep, soft and upholstered at side and back in leather. The windows really move; not by two-handed brute force with the help of a crowbar, but like windows in automobiles. The first high step getting into the car has been replaced by stairs like those of the home. Wherever one stands in the car there is a handrail or grip so near that not even one step is necessary to reach it. Lighting is indirect and provides three times normal street car illumination without glare. Noise is diminished within the car by replacing steel coiled springs with rubber pads. The

wheels are resilient; a combination of steel and rubber so designed that they transmit less vibration and noise than formerly.

Construction of the car was in the hands of Professor C. F. Hirschfeld, chief of the research department of the Detroit Edison Company. He had had, however, no experience in designing street cars. Starting "from the ground up" his first thought was to talk with many street-car riders and find out all the things about this form of transport which they did not like. Afterward he went to the electric railway companies studying economical operation and finally to the manufacturers to have the many ideas worked out.

The new street car will accelerate about twice as rapidly as has been customary. Yet it can do this far more smoothly than do present street cars. Not only will this improved speeding up decrease the running time for a multi-stop route, but it is believed that it will reduce accidents at traffic stops. At present, it is explained, automobiles can accelerate faster than a street car from a standing start. As a result, drivers like to cut over to the car tracks in front of the car as both get under way. With faster acceleration in the new car, 10 per cent. more than that possible in automobiles, it is believed motor cars will be unable to cross over to the tracks because the street car will already be there.

Finding that rubber tires for street car wheels would not, in their present stage of development, stand the strain of service the development engineers have produced a resilient wheel made of steel parts interlocked with rubber. To reduce the transmission of vibration from the trucks up to the car body, rubber springs instead of steel springs are used.

AIR-CONDITIONING OF HOSPITALS

HOSPITALS will increase their patients' chances for recovery if they provide ideal weather in the hospital rooms and wards, in the opinion of Professor C. A. Mills, of the University of Cincinnati, given in a paper read before the American Hospital Association, meeting in Philadelphia. Professor Mills said that his six years' investigation of the effect of climate on health has convinced him that man derives his energy and vitality from the type of climate under which he lives. He pointed out that resistance to tuberculosis, colds, infections of childbirth, kidney diseases and appendicitis are affected by the weather. Moist heat that depresses body metabolism makes for an increased susceptibility to infection and lessened ability to fight bacterial invasions once they have gained a foothold. Of each 100 cases of acute appendicitis handled in hospitals the fatality rate is almost three times as high in the South as in the North, with a steady lowering of the fatality rate as one goes northward from the Gulf region. Close study of the facts indicates that this difference is not due to better hospital or medical handling of the cases in the North, but depends on a basic difference in the human resistance to infection. Acute nephritis shows a similar high death rate in the South and low death rate in the more stormy North.

Hospitals and sanatoriums in most parts of the country should be able to protect their patients from the heat waves of the summer, and tuberculosis sanatoriums in particular should be able to protect their patients the year around from sudden changes in weather. In addition to such air-conditioning, Dr. Mills believes that it would be well to have part of the hospital constructed so that positive atmospheric pressure is available for patients who might be benefitted by it.

Providing ideal weather in old hospital buildings would be exceedingly costly because of the lack of insulation. Professor Mills therefore recommends that special attention be given to insulation of new hospital buildings so that they can be equipped with air-conditioning later if such equipment can not be installed in the first place.

ITEMS

RIGIDLY gripped in the ice of a glacial age such as the earth has never known, the giant outer planets, Jupiter, Saturn, Uranus and Neptune may be rolling forever through space as enormous ice-covered balls. This suggestion is made by Professor R. Wildt, of the University of Göttingen, in a communication to *Nature*. Professor Wildt has taken the known masses of the great planets, and by mathematically parcelling-out has constructed hypothetical models of them that are in accordance with the widely accepted geochemical ideas of Professor H. Jeffreys. At the same time, he says, his theory accounts for the low average densities of the planets which have caused so much difficulty to astronomers. As pictured by Professor Wildt, each of the four giant outer planets has an internal core with a density or specific gravity of 5.5, similar in general to our "home" planet, the earth. Over that is a thick or never-thawing ice. Finally, there is a deep outer envelope of gaseous atmosphere, largely hydrogen, though containing also the great quantities of ammonia and methane lately detected in the planetary atmospheres by Drs. A. Adel and V. M. Slipher.

THAT popular old method of treating a sore throat, gargling, has been subjected to scientific scrutiny and found wanting. "Gargling is ineffective and should be replaced by the gravity irrigation method," according to Drs. William Snow and J. E. Stern, of New York City, in a report made to the American Medical Association. Their conclusion was based on tests in which subjects gargled with a thin liquid suspension of barium while x-ray pictures of the head and neck were made. The subjects tried violent gargling, gentle gargling and tilting the head backward and letting the liquid run as far back as possible without gargling. The x-ray pictures showed that will all these methods the tongue is firmly pressed against the soft palate in such a way that the liquid can not reach the throat. Gravity irrigations with the head and neck bent, such as many physicians use in treating the throat, were found to be successful in getting the liquid back into the throat.

MOTION pictures of a huge "bomb" about 25,000 miles long that shot out from a sun-spot on June 19 and

then exploded above the solar surface were shown to members of the American Astronomical Society, meeting at Connecticut College. The films were made by Robert R. McMath and R. M. Petrie, at the McMath-Hulbert Observatory of the University of Michigan. This is an observatory established by a group of non-professional astronomers especially for taking astronomical motion pictures. The pictures displayed were the first results shown of the work of the "spectrohelio-cinematograph," an attachment for the telescope which permits motion pictures to be made of the sun in the light of a single wave-length. When projected at the usual rate the motion is speeded up about 450 times. Thus changes that would take many hours to observe while watching the sun can be shown in a few minutes.

CHILDREN under school age are more in danger of death from accidents than those who have started their school work, according to statisticians of the Metropolitan Life Insurance Company. Fatal accidents are almost twice as numerous among children under five as among those between the ages of five and fifteen years. Accidents kill more small children than measles, diphtheria and scarlet fever combined. Burns, automobile accidents, mechanical suffocation, drownings, falls and poisonings account for almost three fourths of accidental deaths among children under five. Burns and scalds alone account for a quarter of these deaths. One encouraging feature of the situation is that the accident death rate for this group of children has declined 20 per cent. in the last ten years.

LOBAR pneumonia is being treated with encouraging results by a method originally devised for the treatment of tuberculosis of the lungs, according to a report by Dr. Francis G. Blake, of Yale University Medical School, at the meeting in New Haven of the Connecticut Clinical Congress. The method, known as artificial pneumothorax, consists in putting the affected lung to rest by decompressing or collapsing it. In tuberculosis this promotes healing and prevents extension of the disease. Experience with a large series of cases at the New Haven Hospital showed that the mortality rate from lobar pneumonia can be greatly reduced by this method of treatment. The lung must be collapsed on or before the third day of the disease. If no adhesions are present from previous pleurisy, the treatment causes a dramatic drop in temperature and relief from pain.

IS AMERICA getting wider across the middle or has some slight error crept into either the measuring methods of the astronomers or their arithmetic? Whatever may be the case, the distance between Washington, D. C., and San Diego, Calif., showed an apparent increase of about forty feet in 1933 as compared with measurements made seven years earlier. This discrepancy was reported at the meeting of the American Astronomical Society at Connecticut College by C. B. Watts of the U. S. Naval Observatory. Mr. Watts added, however, that he inclined to the second alternative; it appears easier for astronomers to make an error of forty feet in measuring a line 3,000 miles long than for the United States to grow forty feet "fatter" in seven years.

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SCIENCE NEWS

Science Service, Washington, D. C.

SUBDIVISIONS OF CHROMOSOMES

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DEMONSTRATION of structural details within the chromosomes, considered by most biologists to be the bearers of the "genes" that control the inheritance of physical and physiological characters in animals and plants, compares in importance with the demonstration a few years ago of the divisibility of the atom into smaller electrically charged particles. Like the atom, the chromosome was suspected of being made up of distinct functional units on theoretical grounds for some time before the scientists' "hunch" was proved to be correct.

Dr. Calvin B. Bridges, of the Carnegie Institution of Washington, carried on at the California Institute of Technology and lately in the genetics laboratories of the Carnegie Institution at Cold Spring Harbor, N. Y., researches which have made clearly visible the separate units of which the chromosome is composed.

A brilliant lead, to which Dr. Bridges acknowledges indebtedness, was developed during 1933 by Professor T. S. Painter, of the University of Texas. Professor Painter worked with the "giant" chromosomes found in the salivary gland cells of fruit-fly larvae, which are seventy times the size of ordinary chromosomes. He found on them numerous cross-bandings, which always had the same sizes and spacings on comparable chromosomes. He found also that with particular groups of these bands, groups of known genes could be correlated. This constituted the first truly quantitative, accurate gene-mapping ever accomplished.

When Dr. Bridges went to work, with Professor Painter's results before him, he strove first to penetrate the veil of the chromatin. He developed a technique which enabled him to see through it, to get at what was inside. The chromatin, it developed, was not the important part of the chromosome at all, but only the matrix, the outside wrapping. Now that the contents were visible, it could be seen that what Professor Painter had first described as bandings on the chromosomes were really the edges of solid disks that ran clear through the chromosomes, strung together like beads on a thread. It was seen also that each gene locus corresponded with some special size or shape of "bead," always in the same relative position and always the same in all chromosomes examined, just as they had been on the "bands" described by Professor Painter. "As easily located as the houses on Main Street in the Old Home Town," is the vivid and homely characterization given by Dr. Bridges to the genes' places in the chromosomes.

But that was not the whole story. Not even the units of the now transparent chromosomes were the last words. They proved to be subdivisible also. Each disk is made up a bundle of tiny rods, like a big handful of cigarettes; their ends are visible as dots on the faces of the disk. There is a continuity between these rods, from disk to disk; Dr. Bridges has likened them to segments of the strands in a twisted cable.

So small are these sub-units that many of them are hardly larger than a single molecule of one of the more complex proteins. They may, indeed, be single molecules, or they may be small groups of molecules acting together. Whether these tiny units are the genes themselves, or only the "genophores" or gene-bearers, is a matter of relative unimportance. The important thing is that they have now been unveiled, so that the searching finger of science may probe a little further into the secrets of life.

The principle milestones in the development of modern genetics may be listed as four: Gregor Mendel's proof, three generations ago, that genetic units determine the inheritance of characters; Otto Bütschli's demonstration of the existence of chromosomes; Thomas Hunt Morgan's concept of the gene; Painter and Bridges's separation of the chromosome into its finer structural units and their correlation with the location of the genes.

ELECTRICAL CHARGES ON BACTERIA

BY studying tiny electrical charges on bacteria, so minute that they can be measured only with difficulty, medical science is learning what brings about reactions between disease organisms and the body tissues. In particular, the rôle of "germ electricity" in bringing about the process of agglutination, by which the body fights disease, is being made known. Agglutination is the technical term for a clustering or clumping of bacteria under certain conditions which reduces their mobility and activity in the body.

In a report presented before the Electrochemical Society meeting in New York, Dr. Harold A. Abramson, associate in bacteriology at Cornell Medical School, described the small electrical charges which exist on bacteria and all microscopic particles when immersed in a water solution. Such electricity is not a specific property of bacteria alone but is present also on blood cells, fungus cells, yeast cells and even such inert things as quartz dust and oil droplets when they are immersed in an aqueous solution.

It was the existence of tiny electrical charges on oil droplets, when sprayed from an atomizer, that enabled Dr. Robert A. Millikan, of California Institute of Technology, to measure the fundamental unit of electrical charge—the much-talked-about electron. While Dr. Millikan is now best known to the public for his researches on cosmic rays, he received his greatest award—the Nobel prize in physics—for his work on measuring the charge of the electron.

Dr. Abramson, using a method somewhat similar to that which Dr. Millikan employed, studies the charges on bacteria. Instead of the charged particles being in air, however, they float in a solution. Their rise and fall under the influence of an electric field from two plates immersed in the solution, enables him to study the tiny electric charge present.

In an interview Dr. Abramson indicated that the vir

lent and avirulent forms of the organism causing diphtheria can be distinguished by the electric charges they possess. Certain forms of streptococcus organisms can likewise be distinguished, and it is now possible to classify the different types of organisms which cause pneumonia by the same electrical method.

In his report to the society, Dr. Abramson told how estimates were made, for the first time, of the amount of electricity on a typical microscopic organism like colon bacillus or typhoid bacillus. These disease organisms are so small that about 240,000,000 of them would not occupy more than a square inch. His calculations reveal that only about 300,000 electrons form the electrical charge on each organism.

While 300,000 electrons sound like a large amount of electricity, the electron is a very small unit. Every second an electric light in the home burns, it is using electrons by the millions and billions. So minute is the amount of electricity that despite the extreme small size of the bacteria the electrical charge occupies only about one per cent. of the area.

In a study of the surface electricity of organisms Dr. Abramson found that when agglutination occurs there is still electricity present. Previously held theories indicated that when the bacteria came together in agglutination the electric charge on the surfaces was neutralized and lost. The study of surface electricity on bacteria is important, Dr. Abramson said, because the organisms are so small it is hard to measure anything about them. Accurate determination of the electric charge is one of the few ways they may be studied.

SIZE OF THE GALAXY

(By Science Service)

THE starry galaxy or Milky Way universe in which we live is only half as large as astronomers have supposed hitherto. Shrinking by half the distances of the stars from the earth, latest researches at the University of Wisconsin by Professor Joel Stebbins and his assistant, Professor C. M. Huffer, reduce our "island universe" to about the size of the other galaxies that are found scattered about at great distances in the heavens. Thus once more the part of the universe near us is proved not to be unique.

The astronomical "electric eye" was turned upon 733 stars so hot that they appear bluish in the heavens. All were in the Milky Way. The electric eye measures to a thousand-million-millionth of an ampere the energy sent to earth by stars. With this instrument, which contains photoelectric cell and amplifying vacuum tubes, Professors Stebbins and Huffer confirmed the presence in the Milky Way of a thin layer of dark scattering material which they call dust particles, whose interfering effect has dimmed the starlight and caused astronomers in the past to judge the stars about twice as far away as they really are.

The blue-hot stars, with temperatures of 20,000 to 30,000 degrees Centigrade, three to six times the sun's temperature, have a reddish hue, and this grows more intense the closer they are to the Milky Way's center. This reddish color is caused by a thin stratum of absorbing material near the Milky Way. This layer is believed to be similar to the dark lanes that we see in other galaxies viewed edge on.

THE HEAT OF SOUND

AT the Massachusetts Institute of Technology there has been devised new and more accurate methods of determining the heat of sound. Instead of measuring sound variations in terms of air pressure as does a microphone, the new sound thermometer records the alternating temperatures produced by sound waves traveling in air.

The device was developed at the Round Hill estate of Colonel Edward H. R. Green, M. I. T. research station near South Dartmouth, Mass., by Ellis A. Johnson, of the institute under the direction of Professor Richard D. Fay and Professor Louis Harris.

The sound thermometer is essentially an exceptionally delicate thermocouple comprising thin metal strips of dissimilar metals, bismuth and antimony for example. Each strip is but .00001 centimeter in thickness and is mounted on cellulose acetate films of the same thickness. Together the film and strip are mounted on a thin mica frame.

The thinness of the metal strips may be appreciated when it is realized that a million of them together would make a pile not much more than an inch thick. The amplifier used to "step up" the tiny electrical current generated at the junction of the two dissimilar strips of metal by the heat of sound, is capable of responding to one one-hundred-millionth of a volt.

The thin metal strips or films are so delicate that they do not disturb the sound field they are measuring as do other devices. The sound thermocouple with its amplifier is about 100 times more sensitive than previous couples. It is capable not only of recording the minute variations in temperature produced by sound waves but of recording these variations when they are occurring at many thousands of times each second.

Already the new device has been used to measure the adiabatic heat produced in a sound field up to frequencies of 10,000 cycles a second, and its range can be extended to 300,000 cycles.

The delicacy of the thermocouple makes it an excellent instrument for measuring sound which the ear can not hear, and it is adapted also for light measurements.

COOPERATION OF SCIENCE AND THE PRESS

A STRONG plea for cooperation between science and the press in Great Britain along the lines of Science Service in America was voiced by Sir Richard Gregory, Bart., editor of *Nature*, in his presidential address before the Association of Special Libraries and Information Bureaux meeting at Oxford on September 21.

Stating that "most admirable work for science publicity has been carried on in the United States since 1921 by Science Service," Sir Richard said that "it would be to the advantage of science and the newspaper press if similar organizations for science publicity were established in other countries and cooperated with one another in an international science agency."

"Art and letters, music and religion, have their interpreters in the periodical press and can not complain of any lack of attention to their works or teaching," Sir Richard said. "In its human interests, science can make just as wide an appeal as any of these, but there are few who can review scientific matters with the independent and critical mind which estimates the value of opinions or performances in other spheres. A bare announcement of a scientific discovery may be worth publication as an item of news, but not much more so than a report that an important creative work has been completed by an eminent artist or man of letters. Supplementary to such news, reasons must be given why the discovery or work is of particular significance; which means that its characteristics must be clearly described by a competent writer."

"It is surely the duty of the press," Sir Richard declared in his concluding remarks, "as a service of public utility and the man of science as a citizen as well as a discoverer, to affect a rapproachement in order to create a public opinion which will ensure that no advantage may be lost which might accrue from the application of the results of scientific research to the needs and amenities of daily life. A more intelligent and more intelligible consideration of scientific work and thought is desirable in the public press because of their close contacts with many national and international problems. Under the conditions of modern civilization, the community in general is dependent upon science for its continued progress and prosperity. Under the influence of modern scientific discoveries and their applications, not only in industry, but also in many other directions, the whole basis of society is rapidly becoming scientific; and to an increasing extent, the problems which confront the national administration involve factors which will require scientific knowledge for their solution.

"It is in these directions that the press can render the greatest service to science and the public at the same time. Under the present social and educational system, it is not possible to hope that at any very early date our schools will turn out a population of scientifically-trained men and women. But it is becoming recognized, though slowly too, that what is needed is not so much detailed or expert knowledge of science, as the scientific outlook. The function of the press, more readily to be appreciated perhaps when something of this scientific spirit has been inculcated in the schools, might very well be, by fostering this outlook, to ensure that the problems of government and administration of society and of economics, are approached with scientific understanding."

ITEMS

THE first atomic weight determination of proactinium, next to the heaviest element, have been made by Professor Aristid Von Grosse and M. S. Agruss, of the University of Chicago, who recently isolated this element for the first time. The value of its atomic weight is 231 with an accuracy of 0.5 per cent.. Announcing results to the inorganic group of the Chicago section of the American Chemical Society, it was explained that the one tenth gram of proactinium oxide recently isolated was used for that purpose. The pure compound potassium proactinium fluoride was prepared and converted into the oxide, using platinum equipment exclusively. The ratio of two molecules was determined by means of a sensitive ultra-micro-balance. From this ratio the value of the atomic weight was determined. This atomic weight fixes also the values of all other elements of the actinium radioactive series and is in complete agreement with the result of Professor F. W. Aston, on actinium lead obtained with his mass spectrograph.

STARS so intensely hot that most of their radiation is in the invisible ultra-violet region, "cool" yellowish stars like our own sun, and the relatively chilly red stars like the giant Antares, have all had their temperatures taken by Dr. Charles G. Abbot, secretary of the Smithsonian Institution, and Dr. Joel Stebbins, director of Washburn Observatory at the University of Wisconsin, who worked together during the past summer at Mount Wilson, Calif. Using in combination a set of filters that pass only certain colors, or bands of wave-lengths in the stars' radiation, and an exceedingly sensitive photocell devised by Dr. Stebbins, the two scientists "took apart" starlight from stars many light-years distant from our own solar system, and measured the amount of energy in each constituent part.

THORIUM and uranium, heavy elements continually breaking down in nature's process of radioactive disintegration, are now used by industry. New photoelectric cells for studying ultra-violet radiation in that region of light which produces sunburn employ uranium, while thorium is placed in many types of vacuum tubes. These little known practical applications of thorium and uranium were described before a recent meeting of the Electrochemical Society by J. W. Marden, of the Westinghouse Lamp Company. When a layer of thorium only a single atom thick is coated on a tungsten filament in a lamp the lamp filament increases its emission of electrons. Where an increased electron emission in a specific tube is desired the thorium coating is sometimes the answer to the problem. Uranium, sensitive to light, is used in photoelectric cells where science needs an instrument to study the intensity of the invisible ultra-violet rays.

SOMETHING besides the tuberculosis bacillus is responsible for tuberculosis. This was the consensus of opinion of tuberculosis experts who discussed the question at the recent meeting of the American Hospital Association. The discussion was opened by Dr. C. H. Sprague, of Broadlawns Polk County Public Hospital, Des Moines, Iowa. Dr. Sprague pointed out and other physicians corroborated him that cases of tuberculosis have decreased unexpectedly during the period of economic depression. This led him and other tuberculosis workers to wonder whether the factors of good food, good homes, fresh air and cleanliness were of such importance in preventing tuberculosis as has been supposed. Examination of all children in order to detect possible cases of tuberculosis was universally accepted as a measure of prime importance in fighting the disease.

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SCIENCE NEWS

Science Service, Washington, D. C.

CONFERENCE ON PHYSICS

CABLED REPORTS BY DONALD CALEY,
London Correspondent

MATTER being annihilated in the heated interiors of the stars and flashing "new star" novae as the origin of the cosmic rays was suggested by Dr. R. A. Millikan when he reported to the International Conference on Physics the first details of the very high altitude survey of cosmic rays made by the California Institute of Technology research team consisting of Dr. Millikan, Dr. I. S. Bowen and Dr. H. Victor Neher.

The only source of the observed cosmic ray energies now in sight, Dr. Millikan reported, is the annihilation of matter. But the softest components of the cosmic rays have energies corresponding to the partial annihilation or atom-building hypothesis, while the energies of the hardest correspond to the complete annihilation of atoms. Thus in his latest interpretations Dr. Millikan sees the cosmic rays as both the "death cries" and "birth cries" of matter. These mysterious penetrating radiations are seen as the signals of both tearing down and rebuilding of the stuff of the universe. The process of annihilation and atom building conceivably take place, Dr. Millikan suggested, because of the ease with which hydrogen particles cluster at the extreme heat of interstellar temperature. Or they may happen because of the extremely high temperatures found in novae, as suggested by Dr. Fritz Zwicky, one of Dr. Millikan's colleagues at California Institute of Technology. Another outstanding conclusion by Dr. Millikan is that photons or radiation of the same kind as ordinary light are responsible for most of the cosmic ray effect or ionization found at sea-level or underneath the sea. This is in accord with his previous findings and is opposed to the ideas of some other cosmic ray observers. The resistance of the atmosphere to incoming electrons, suggested by some as composing the cosmic radiation, would require energies of a billion electron volts on the basis of encounters outside the nucleus of the atoms and five billions of electron volts on account of the encounters within the nuclei of atoms. Nuclear electron encounters were seen as producing only very soft secondaries consisting of both photons and electrons. Dr. Millikan also reported that nearly all the non-field sensitive part of the ionization of the atmosphere above sea-level is due to photons of energy below 500 million electron volts. In the equatorial belt of the earth a small part of the ionization is due to incoming secondary electrons of energies as high as ten billion (10,000,000,000) electron volts. These are responsible for the east-west and the longitude effect found in the earth's equatorial belt. The part of the ionization that is sensitive to the earth's magnetic field increases rapidly with increasing latitude from Panama to Spokane because incoming secondaries of energies decreasing from eight to two billion get through the field's blocking effect in rapidly increasing numbers with increasing latitude, adding greatly in northern latitudes to the underlying ionization of the upper air produced by incoming photons.

PROBING into the region of the extremely minute, where atoms come together to determine the character of larger aggregations of matter, physicists attending the joint conference of the International Union of Pure and Applied Physics and the Physical Society have heard Sir William Bragg keynote the inquiry: "We must look into the region of crystals composed of atoms for explanation of the quality of a steel or bronze, a glass, a textile fiber, a living nerve and other substances. And somewhere here enters the breath of life to control atomic composition which enters into living mechanisms." All investigations of solid bodies of every form, whether animal, vegetable or mineral, have as their primary aim, Sir William said, the connection between the properties of the body on one hand and its composition and architecture on the other hand. Some of these properties are directly dependent, he explained, on the few atoms and crystals of the unit cell. The arrangement of the unit cells determines the behavior of the body as a whole. Some other properties depend on the action of atomic forces in groups of hundreds, thousands or even tens of thousands of atoms. It is pleasant, Sir William told the physicists, that a crystal responds to every effort to improve the accuracy of the measurements that scientists make upon it. He called attention to the distinction made by Professor Adolf Smekkal, of Halle, between "insensitive" effects which are functions of the composition of the crystal itself and the "sensitive" effects which depend upon the crystal's treatment and previous history. Large discrepancies have appeared in the investigations upon solids and the physicists are searching for the cause. For example, the cohesive force of rock salt calculated from the knowledge of its structure and its ionic composition is about 200 kilograms per millimeter, whereas the experimental value is usually less than a single kilogram per millimeter.

ARTIFICIAL production of radioactive elements useful in medicine and superior in intensity to radium was predicted by Professor J. Joliot and Irene Curie Joliot, of Paris, who discovered artificial radioactivity less than a year ago. The Joliots expressed their hope of producing superior radioactive elements with useful properties not possessed by the naturally radioactive substances in the development of which the famous parents of Mme. Joliot played such an important part. These powerful radio-elements that the Joliots foresee when introduced into the living body must behave very differently because of their chemical properties and the fact that they will disintegrate without leaving a radioactive residue. This has great possibilities in medicine. It may mean a new kind of cancer treatment in which artificial radioactive substances produced cheaply can be introduced directly into the cancerous tissue to do their work and then become harmless. The Joliots speculated upon just what

happens within the central portion of the atom when it becomes artificially radioactive. They attributed the emission of electrons and positrons to what they called an "internal materialization" of gamma radiation, radiation of the same kind as light and x-rays. The gamma radiation, they suggest, is transformed into a positive and negative electron in the process of leaving the central portion or nucleus of the atom which gave rise to it. In this manner neutron radiation and gamma radiation are emitted when beryllium is bombarded with the cores of helium atoms, called alpha particles, which are shot off from the naturally radioactive substance polonium. But the Joliots found it difficult to imagine what happens within the atom's heart when neutrons are the bombarding particles. A possible interpretation is that the entrance of a neutron is followed by an expulsion of a negative proton, a particle that has not yet been discovered. This expulsion of a negative proton might explain the formation of a substance heavier than any hitherto known, chemical element 93. Such an element has been reported by Professor Enrico Fermi, of Italy, but doubt has been cast upon its actual existence. Certain experiments, the Joliots reported, suggest that neutrons bombarding phosphorus could produce radioelements themselves emitting protons. Natural radioelements, like radium and uranium, are said to be apparently rare survivors of numerous elements which existed under conditions of temperature, pressure and radiation different from those existing now on earth. This must have been millions of years ago.

THE strange fact that two varieties of a radioactive element, exactly the same in mass and in charge, have very different periods of life excited discussion. One of the newly discovered artificial radioactive elements, the mass thirteen isotope of nitrogen, has different periods of decay depending upon how it is produced. Dr. J. D. Cockcroft, of the Cavendish Laboratory of the University of Cambridge, described the making of nitrogen thirteen both by bombarding carbons with protons and with deutons. In both these cases the "half life period," or the time that it takes for half of the newly manufactured nitrogen to disintegrate is ten and a half minutes. But if this nitrogen isotope is made by the method discovered by the Joliots of Paris, bombarding boron with alpha particles, it has a decay period of fourteen minutes. "This proves that some nuclear component or condition as yet unknown must exist," Dr. Cockcroft said in an interview. Wide support was given in the conference for the existence of two particles of matter, the neutrino and the negative proton, which physicists have not yet discovered, although their existence has been suspected. Experiments looking toward the use of neutrons in medicine, somewhat in the same way as radium rays and x-rays are now used, are being made by Professor J. C. McLennan, emeritus professor of physics at the University of Toronto now resident in England.

DR. ENRICO FERMI, the Italian physicist whose experiments on bombarding heavy uranium with non-electrical particles known as neutrons, has set the world of science in a controversy over whether or not super-heavy element No. 93 was created, has performed similar experiments on the element thorium. In an interview Dr. Fermi indicated that his preliminary experiments make him inclined to anticipate the discovery of a whole new radioactive family between the elements actinium and thorium. Actinium has atomic number 89 in the periodic table of the elements. Its atoms weigh about 227 times as much as those of hydrogen. Thorium has atomic number 90. Its atoms are 232 times as heavy as hydrogen. By his atom-bombarding experiments Dr. Fermi has discovered two radioactive substances of thorium having periods of one and fifteen minutes during which they decay, or disintegrate to half their amount. These are the first two members of the new, anticipated radioactive family for which he is searching. They are probably isotopes of thorium or actinium since there is no gap in the table of the elements at this point.

A PARADOXICAL action of gamma rays, one of the radiations from radium, was reported by Dr. R. A. Millikan to the conference on behalf of his Pasadena colleagues, H. R. Crane and Dr. C. C. Lauritsen, of the California Institute of Technology. They found that the higher the energy of a gamma ray the more it is absorbed. These experimenters produced gamma rays by bombarding lithium and fluorine with protons and beryllium, boron and carbon with deutons. A record was made when the maximum energy of the gamma rays was measured as between twelve to thirteen million electron volts. The theoretical physicists had a difficult time keeping up with the experiments reported. One suggestion of what happens in the central portion of the atom was made by Professor G. Gamow, who is lecturing this year at the George Washington University. Professor Gamow suggested that within the nucleus there is an exchange of a proton and negative proton for nuclear neutrons. This change does not affect the mass or charge of the atom but it does provide an explanation of the uranium transformation. Professor Fermi expressed doubt, however.

THE production of a new kind of helium of atomic weight six instead of the usual four was reported by Professor M. L. Oliphant, of the University of Cambridge. Dr. Oliphant was one of the discoverers of triple-weight hydrogen. The new helium of atomic mass six was obtained by bombarding beryllium with deutons, the hearts of double-weight hydrogen.

DR. ARTHUR H. COMPTON, of the University of Chicago, reported that there seem to be two kinds of cosmic ray bursts, an ordinary sort and a rare type about four times larger than the usual kind. This is very difficult, to explain by any known nuclear process and the ordinary explanation would involve an element of atomic weight 1,000." The heaviest known element, uranium, has an atomic weight of 238. Dr. Compton was led to this conclusion by cosmic ray measurements made this past summer in the American Rocky Mountains with Dr. G. S. Brown, Dr. H. A. Rahmel and Professor R. D. Bennett, of the Massachusetts Institute of Technology.

HOSPITALS OF SOVIET RUSSIA

RUSSIA'S present contrasts between modern efficiency and antiquated inefficiency can be found in hospitals and medical and surgical practise as well as in industry and agriculture, according to Dr. William N. Walsh, hospital consultant of Chicago, who has returned from an independent inspection tour of Russia. Dr. Walsh attended the sessions of the American Hospital Association at Philadelphia.

Lack of funds is the chief handicap under which Russian physicians, surgeons and hospitals labor. Lack of funds and high cost of quinine is the reason why there is so much malaria in Russia. Dr. Walsh was unable to buy quinine anywhere in Moscow. Lack of funds is also responsible for the large number of typhoid fever cases in Russia.

While these two diseases are causing too much disability, venereal diseases have been reduced by 50 per cent. in Russia during the last decade. This is largely due to the fact that commercial prostitution no longer exists, Dr. Walsh explained.

In the large cities many of the hospitals are well equipped, modern buildings, while others are old-fashioned and poorly equipped. Russian indifference to odors was apparent in the wards. Noticeable also was the lack of soap, which necessitated washing floors with kerosene instead of the usual soap-suds.

Russian surgeons are doing excellent work, in Dr. Walsh's opinion, but nursing is far below American standards. In some hospitals he found surgeons operating without rubber gloves. Upon inquiry, he was told that the only ones they could afford were the heavy kind which American women wear to do housework and to wash dishes, and which are unsuited to the fine manipulations the surgeon has to make.

Russians are second to no people in the world, as far as their ideals and practises in the care of mothers and children are concerned. In fact, the Russians do not believe they will have much need for hospitals in the future; they expect coming generations to be so healthy, as a result of the care they receive from infancy onward, that they will not get sick and need to go to hospitals. Many of the older people are suffering from chronic diseases, largely as a result of conditions under which they formerly lived. Russian physicians, surgeons and hospital executives are well aware of the family conditions now existing and are trying to remedy them as quickly as possible.

In marked contrast to the picture Dr. Walsh painted of conditions in Russia was the discouraging report of Dr. Donald M. Guthrie, of Sayre, Pa., on conditions he found in Germany and Austria. Dr. Guthrie said that the medical profession has fallen into disrepute in these countries and that if present conditions are allowed to continue much longer, medicine will sink into a bog of absolute inefficiency.

ITEMS

THE village of some of Sweden's Stone Age hunters and fishermen, 4,000 years old, has been found on the shore of picturesque Valdemar Bay on the southeast coast. Professor O. Janse, archeologist who made the discovery, expects to find other, similar settlements in the region. He unearthed quantities of fish and animal bones cast aside by the villagers from their meals, and also the pieces of their earthenware vessels.

DR. ALEŠ HRDLIČKA, of the Smithsonian Institution, has discovered broken heads and other signs of combat in excavations just completed on Kodiak Island. He had been puzzled by the occurrence of "nest burials," heaps of skeletons of all ages, and both sexes, with none of the ceremonial offerings that were ordinarily placed in ancient graves. It now appears that epidemics do not explain these unusual Alaskan burials, but instead there is strong indication that enemies massacred a village, and the few survivors must have returned later to bury their dead in heaps.

A PARADE of the horned dinosaurs, four of their huge, bony skulls in a row, has been arranged at Yale University in the Peabody Museum. The four monster skulls show how evolution revised the dinosaur "models" 60,000,000 years ago in America. Some of the early horned dinosaurs went armed with a big nose horn like a sword to ward off or impale their enemies. Over their brows, these dinosaurs carried small horns, too. Later the horn pattern changed, the nose horn becoming smaller and brow horns developing. The Triceratops, which brings up the rear, is famous because it had the biggest head and in comparison the smallest brain of any land animal known on earth.

NAPHTHALENE crystals, the stuff mothballs are made of, have been found a good means of chemical warfare against the Japanese beetle, one of the worst of the introduced insects pests along the Atlantic seaboard. Experiments by Dr. Walter E. Fleming and Francis E. Baker, of the Bureau of Entomology, U. S. Department of Agriculture, have shown that eggs, larvae and pupae of the beetle can be killed in suitably prepared greenhouse soil, and that when used out of doors a thousand pounds of the odorous crystals per acre of ground will discourage the females from laying their eggs, though it will not stop them from burrowing.

"FOREST PRIMEVAL" conditions are to be preserved strictly in an area of 801,000 acres in the northern part of the state of Washington, newly set aside as the "Cascade Primitive Area," by F. A. Silcox, chief of the U. S. Forest Service. This region, considerably larger than the state of Rhode Island, will have its rugged picturesqueness inviolate against the building of hotels or cabin colonies, and even of roads. Primitive areas, of which the new Cascade region is the latest and largest, are purposely kept without man-made "improvements" and held for the dual purpose of scientific study and recreation by those who can live in the wilderness on its own terms.

SCIENCE NEWS

Science Service, Washington, D. C.

CHEMICAL IDEAS IN MEDICINE AND BIOLOGY

By Watson Davis
Director, Science Service

Sex, cancer, vitamins and virus diseases were linked together by Sir Henry Dale, director of Britain's National Institute for Medical Research, when at the dedication of the new research laboratores of Eli Lilly and Company he discussed striking relationships between substances once considered quite unconnected.

Investigators have discovered that the sunshine vitamin D, coal tar products causing skin cancer, and both the male and female sex hormones have a type of chemical structure which shows them to be in the same chemical family. In fact, Sir Henry explained, large doses of one of these substances will often act like one of the others, as when vitamin D is given in excess to female rats with the result that their sexual activity is quickened. Even more startling is the discovery that the coal tar substances causing tumors in chickens seem to set up a cancer disease that becomes an infection.

Dr. Peyton Rous, of the Rockefeller Institute for Medical Research, first found that this kind of cancer could be transmitted by injections of the fluid filtered from cancerous materials. Now it is found that cancer caused by a coal tar substance injected into muscles can be carried from chicken to chicken by the same method. This surprising fact seems to indicate that an infectious disease is created by a chemical substance acting in some way upon the living body.

Such experiments bring into connection the supposedly living ultra-germs or viruses and the powerful chemical substances known to be contained in the vitamins, hormones and other such admittedly non-living substances. What are these viruses? Sir Henry raised the question since they do not seem to be wholly chemical and it is difficult to imagine them as living organisms in the ordinary sense. The discovery of their exact nature is considered by Sir Henry as a great medical problem closely related to the secret of the cause of cancer. He predicted that useful medical developments in the future will come from continued research along these lines.

A chemical released in the nerves of the body every time a thought commands a nerve to move a muscle was also described by Sir Henry in a special paper. The message-carrying chemical is acetylcholine. Few people have ever heard of it. Yet it is the chemical that carries messages from nerves to muscles. This performance is suggested by several researches in past years but the reality of the effect is only now being recognized. The theory contends that almost infinitesimal amounts of this chemical are released whenever there is a thought that commands a nerve to order a muscle to move.

Hundreds of times a second extremely small spurts of acetylcholine are produced in the body of an active person, each one bridging a gap from nerve to muscle. It is hard to imagine the small amount of this chemical that is needed to act as chemical postman. Sir Henry computed that each outpouring spurt of acetylcholine consists of only three molecules. When he attempted to express its weight in grams, the scientific unit of weight that is one thirtieth of an ounce, he had to write twenty naughts to the right of a decimal point before a figure was reached.

If this chemical theory of how nerves control muscles really fits the facts, acetylcholine will be recognized as one of the most important substances in the living body, with great potential usefulness in medicine.

COSMIC RAYS AND THE OZONE LAYER

New studies of the stratosphere 12 to 20 miles above the surface of the earth are being made in Germany by Professor Erich Regener, of the Physical Institute at Stuttgart. Small free-flight balloons are used in the investigations. They carry aloft automatic instruments in the manner proposed in the new research program of Dr. Arthur H. Compton, of the University of Chicago.

Studies of cosmic ray intensities up to altitudes of 17.5 miles, Professor Regener reports to *Nature*, indicate cosmic rays have the same specific ionizing power over the whole region investigated from the surface of the earth up to the greatest heights studied.

Other balloons bearing a quartz spectrograph were sent up to altitudes of 13, 12.5 and 19.5 miles. An examination of sunlight at these heights disclosed that at 13 miles 40 per cent. of the protective layer of ozone in the earth's atmosphere was then below the instrument. At 19.5 miles 70 per cent. of the ozone was below the instrument.

Ozone is atomic instead of molecular oxygen. It has a characteristic odor noticed when a quartz arc is operating and occasionally after a lightning bolt strikes nearby. Because it strongly absorbs the ultra-violet rays of sunlight, ozone in the earth's atmosphere is often called a protective layer. Without ozone's presence sunlight would be so intense that plants, animals and people on the earth could not live on the earth in the manner they do now.

Studies of the height of the ozone in the atmosphere were performed in collaboration with Dr. Victor H. Regener. The cosmic ray studies were made with Dr. Georg Pfotzer.

Describing the results of the ozone studies, Professor Regener writes: "These results are remarkable because they confirm recent calculations predicting that the height of the ozone layer is much lower than previously supposed."

STUDIES OF ATOMIC COLLISIONS

An improvement in the apparatus with which science takes photographs of atomic collisions in experiments on cosmic rays and artificial disintegration is announced in the current issue of *The Review of Scientific Instruments*. The improvement is expected to aid physicists in their study of the impact of cosmic rays on air atoms and in

The Science Press Printing Company

An article entitled "The Journal *Science* and the American Association for the Advancement of Science," printed in the issue of the journal for October 8, 1926, contains the following paragraphs:

> In this connection acknowledgment should be made to the printers, The New Era Printing Company of Lancaster, Pa., and especially to Mr. Andrew Hershey. In 1893 they were printers of a local newspaper and of local job work. They offered terms much lower than any city printers and maintained the same rates for SCIENCE for twenty-five years. They proved themselves to be excellent printers and in 1920 were printing some fifty scientific journals. After one partner had died and the other two had advanced in years, the business was sold to a promoter, not himself interested in printing. Charges were greatly increased and the printing became less efficient.
>
> Efforts were made to purchase the printing plant with cooperative ownership by the scientific journals that it printed, but these failed, partly because the $300,000 asked included at least $100,000 for the good will in large measure given to the business by SCIENCE, and partly owing to the difficulties of ownership by the societies and institutions that controlled the journals. When the Carnegie Institution was established in 1902, the editor of SCIENCE proposed the organization by it of an office for scientific printing and engraving which could have been made self-supporting, and, as in the case of the Oxford and Cambridge presses, would have rendered valuable service by assured continuity and expertness in scientific printing; but the plan was not adopted.
>
> SCIENCE and the other journals of The Science Press were for a time printed in Utica, N. Y. In 1923 The Science Press Printing Company was incorporated with its office at Lancaster and with the cooperation of Mr. A. E. Urban as general manager and of those compositors, pressmen and proofreaders who had given that city distinction as a center for scientific printing. This company is now responsible for printing SCIENCE and a considerable number of other scientific journals, monographs and books.

As stated in this quotation The Science Press Printing Company was established to print SCIENCE and the other publications of The Science Press, including *The Scientific Monthly, The American Naturalist, School and Society,* and the Biographical Directories of "American Men of Science" and "Leaders in Education." The composition and press work of these publications show the high standards that are maintained. In order to bring them out efficiently and promptly —for example, the entire contents of an issue of SCIENCE can be put in type in one day and each week during 1933 about 14,000 copies of SCIENCE were printed, bound and mailed in a little more than one day—it has been necessary to have a shop of considerable capacity and to take in other work. The press now prints some thirty scientific and educational journals and series, and has printed many books and monographs.

It may be regarded as a real contribution to science that there should be a plant in which the workers are trained to deal with scientific material. Innumerable commendations of the accuracy of the proofs have been received; to quote only one, the late Professor E. S. Morse wrote to the editor of SCIENCE: "I corrected my first proof a year before you were born and the one I returned yesterday was the first one in my long experience that needed no correction."

It is also an advantage for scientific men to have relations with a company that maintains the same rates for the same kind of work under the same conditions. High pressure selling and competitive bidding—among the causes of the present economic depression which the codes promoted by President Roosevelt are intended to abolish—are thus unnecessary. A scientific man may assume that work entrusted to the press will be done at a cost as low as is consistent with high standards of work and the best conditions of employment for the workers. This is less than the cost of equally good work in large cities where wages and rents are much higher, but it is not so low as for inferior printing or where the welfare of workers is disregarded.

While the press must use efforts to obtain work when the capacity of the shop requires it, its object has been to make it as great an advantage for the scientific man to have work done by it as it is for it to do the work. This policy has succeeded, for employees have not on the average been idle as much as one day a year since the press was established; no employee has been laid off (up to October, 1934) even during the economic depression; wages were decreased by 10 per

cent. for only about fifteen months, when costs of living were lowest; the press has a profit sharing system for employees; all earnings on the stock have been used to improve the plant. The Science Press Printing Company is a business corporation; but it is also a scientific institution. It is conducted on the same principles as the journals that it prints. Its object is the advancement of science—at the same time it must be self-supporting, and it is desirable to make profits that are used to increase its usefulness.

Adequate facilities for the publication and printing of research work are essential for the advancement of science. The cost of conducting a piece of research that deserves publication, counting the time of the scientific workers and all overhead, may on the average be $2,000. The charge for printing by The Science Press Printing Company of a 32 page article or monograph in an edition of 1,000 copies is about $80, say 4 per cent. of the cost of the research. This is less than the interest on the investment, if there is a delay of a year in publication. Ordinary depreciation on machinery is charged at 10 per cent. a year, but it is much larger in the case of scientific research where delay seriously lessens the usefulness of the work and prevents the early recognition of its value. It is most important for science and for scientific men that there shall be prompt and efficient printing and publication of research.

The Science Press Printing Company has had more work offered to it continuously than it could do promptly, but owing to the completion of the printing of "Leaders in Education," followed by the fifth edition of "American Men of Science" (equivalent to 5,000 pages of the usual book) recently completed, it will soon want one or two scientific journals or several books and monographs in order that the full capacity of the shop may be used and all employees be given steady work. This is not only a need of the press but also an opportunity for those who take advantage of it. It is further reasonable to assume that The Science Press Printing Company deserves the support and cooperation of scientific men to the same degree as an institution, a society or a journal that contributes to their welfare and to the advancement of science.

Dr. J. McKeen Cattell was responsible for the organization of The Science Press Printing Company eleven years ago and has been president of the corporation. Since the untimely death in 1927 of A. E. Urban, the first secretary and manager, Jaques Cattell, one of the editors of the last two editions of "American Men of Science," has been secretary and later also vice-president; George M. Houck has been associate manager in charge of the composing room and later manager; Miles W. Eckman has been associate manager in charge of the press room. Inquiries concerning printing should be addressed to the secretary at Lancaster, Pennsylvania.

THE SCIENCE PRESS PRINTING COMPANY

LANCASTER, PENNSYLVANIA

New York Office
Grand Central Terminal

the investigation of neutron bombardment in artificial radioactivity.

Professor L. M. Mott-Smith, of The Rice Institute, Houston, Texas, describes a new type of Wilson cloud chamber, the apparatus in which atomic collisions are studied. It is especially designed for operation at high pressures up to fifteen atmospheres, or about 225 pounds' pressure to the square inch.

In studying collisions occurring in this type of instrument it is only possible to sit by and wait for impacts to occur. At intervals they take photographs in the hope that at the instant of photographing a collision is occurring. It is a slow business for some of the rarer happenings in atomic collisions. Higher working pressure within the apparatus means that more gas atoms are present on which cosmic rays or neutrons may strike. The chance of obtaining the desired kind of pictures is thus increased manyfold with higher pressures.

The cloud chamber apparatus was the invention of Professor C. T. R. Wilson, of London, in 1912. So valuable has it been for research on the structure of the atom and its nucleus that he was awarded the Nobel Prize in 1927 for developing the technique.

Cloud chamber apparatus makes possible photographs of the tracks of the swiftest moving particles. As these particles rush through the gas of the chamber they knock electric charges off the atoms present in the path. By a movable piston arrangement water vapor is made to condense into little water droplets along the ionization path. Such drops show up white and can be photographed.

THE CASTING OF A REFLECTING LENS

THE world's largest block of glass—originally intended for the proposed 200-inch reflecting telescope of the California Institute of Technology—has now been completed. Officials of the Corning Glass Works have announced that the 20-ton piece of glass will be removed from the annealing ovens to make way for another twin glass disk.

Over half as wide as the average city lot and more than two feet thick, the great glass block, shaped like a slice of pineapple as it comes from the can, has served as a valuable "trial horse" for future work. Having learned by experience the problems incidental to the pouring and casting of such a large piece of glass, engineers of the glass works are now spurring work on a second disk the same size.

The present block of glass, it is claimed, would make a satisfactory telescope mirror, but a great amount of grinding would be necessary because of the unfortunate accident which occurred at the pouring last March. At that time ceramic material used to produce a honeycomb back on the disk floated to the surface and had to be removed. The present block, therefore, is solid glass throughout. It is simpler, declare the Corning scientists, to pour and cast a second disk.

It would have been extreme good fortune indeed if the first disk cast had been chosen for the 200-inch telescope mirror. Astronomers recall that when the French optical firm was casting the disk for the great 100-inch mirror of the Mount Wilson instrument, three castings were made. After tests the best one of these was chosen. It happened to be the first cast.

The pouring of the second 200-inch disk—17 feet across—should occur before the end of the year, it was announced by scientists of the Corning Glass Works.

THE HELIO-TECHNICAL INSTITUTE OF SAMARKALAND

SCIENTISTS and engineers of Soviet Russia are making experiments in which the heat energy of solar radiation may be turned into usable power on earth. In keeping with its program to duplicate the work of the western civilization in every form of technology Russia is now tackling the century-old problem of how to run steam engines by the energy streaming down from the sun.

At the Helio-Technical Institute of Samarkaland (Central Asia) a solar air heater is in operation. It dries vegetables and fruit in a few hours where older methods required days.

At Tashkent, also in Central Asia, in what used to be Turkestan, research for several years has been progressing on solar energy plants. A kitchen is being operated. Food is cooked, water boiled and water pumped up to a small water tank. So hopeful are Soviet engineers of solar energy that a power plant of 30,000 kilowatts' capacity is to be erected either on the shores of the Aral Sea or on the bank of one of its tributaries, the Amu-Daria River.

The latest design of pump to be used in this plant calls for movement of 4,000 cubic meters in 10 hours. Converting cubic meters into gallons of water yields the rather astonishing result of over a million gallons pumped in less than half a day. Likewise astounding is the amount of energy in sunlight. Each year the energy falling on the earth is 1,000 times as much as that obtainable from all the coal, oil and water-power used in the United States yearly if it were all available for power transformation.

But like all forms of energy conversion there is the question of efficiency in obtaining power from sunlight. One of the best methods, that of Willsie and Boyle in the early years of the present century, was not more than one or two per cent. efficient.

A GEOLOGICAL FORMATION IN WYOMING

WHAT the world looked like during the Devonian Age, which preceded the Age of Coal, may be partly reconstructed from an examination of a newly discovered geological formation at Beartooth Butte, Wyo. This formation, consisting of massive gray limestones and thin red shales, is rich with fossils of plants that grew on land and fish that swam the sea in those remote days. Together they constitute a "Lost World" picture beside which the product of the Wellsian imagination looks modern.

This place where land and sea life left their remains in the same ooze beds, to be changed later into rock, was apparently a wide river mouth, or estuary. The land plants grew as lush shore vegetation, and the water animals swam and scrambled near their roots.

Dr. Erling Dorf, of Princeton University, who ex-

plored the area, states that he has identified five fossil species of land plants, all of them ranking among the earliest forms of above-water vegetation. They belonged to an exceedingly primitive fern-like group, entirely extinct now, known to botanists as the psilophytales. The animal groups are represented by a total of 29 species, some totally extinct, some with still-living though markedly different modern relatives. The totally extinct groups include ostracoderms, which were armor-plated, fish-like animals now believed by some geologists to be the ancestors of fishes and through them of all other backboned animals. There is also a species of large eurypterid, or "sea scorpion." The eurypterids were great jointed animals, looking vaguely like lobsters, which attained five- or six-foot size. Finally, there are fossils of arthrodires, which were true fishes, cased in heavy plate armor.

Still-living groups are represented in the new formation principally by sharks. There are, however, fossils of a species of lungfish, which may possibly be evidence that the world then had wet and dry seasons as it has now; for the few surviving present-day lungfishes all live in regions where their ability to breathe air with their primitive bladder-like lungs enables them to retire into mud cocoons and survive fierce and almost waterless summer droughts.

Dr. Dorf will give full technical details of his study in the forthcoming issue of *The Journal of Geology*, published at the University of Chicago Press.

THE GULF STREAM

THE Gulf Stream does not originate in the Gulf of Mexico, two years of research by the Bingham Oceanographic Laboratory of Yale University have determined. Professor Albert E. Parr, scientific director of the Yale oceanographic expeditions, in charge of this work, now believes that the name "Gulf Stream" is a misnomer and should be changed.

The first known oceanographic survey of the Gulf of Mexico was made in the winter of 1932 by the Yale oceanographic expedition on the *Mabel Taylor*, with the cooperation of Drayton Cochran, of New York City. The many observations made during this survey have subsequently been analyzed in the Bingham Laboratory at Yale. According to Professor Parr, the work has progressed far enough to make it possible to say that the upper layers in the Gulf of Mexico are made of waters quite different from that of the upper layers of the Caribbean and also of the Gulf Stream.

Gulf of Mexico water seems to enter into relatively very little exchange with the waters of the surrounding seas and generally contributes little or nothing to the waters of the Gulf Stream, Professor Parr and his co-workers have found.

"The observations made," according to Professor Parr, "provide evidence to prove the theory already advanced by Danish investigators that the so-called Gulf Stream simply takes the shortest possible route from the Yucatan Channel to the Straits of Florida along the north coast of Cuba, carrying chiefly or exclusively waters brought directly from the Caribbean, with little or no contribution at all from the Gulf of Mexico.

"The popular name of the Gulf Stream is therefore certainly a misnomer, and should be replaced by a more suitable designation such as, for instance, the term 'Florida Current' which is now gaining wider usage among oceanographers and nautical people. Perhaps 'Caribbean Current' would really be the most fitting designation."

ITEMS

MIGHTY even in its overthrow, one of Yosemite's Big Trees, estimated to be nearly 2,000 years old, lies stretched along the ground in Mariposa Grove. The old sequoia, widely known as the Stable Tree because of a great burned-out place in its base in which horses were stabled in stage-coach days, was 269 feet high and 29½ feet in diameter at its base. The fall of the Stable Tree is attributed by park authorities to the great fire scar which had burned out its center more than two hundred years ago, greatly weakening its hold in the ground.

BEAUTIFUL and varied species of wild birds and animals of the Virgin Islands are to be given protection from destructive over-hunting, under plans now being worked out in the U. S. Department of the Interior. Although the islands are small, they still have fairly extensive game-harboring areas, where there are deer, white-crowned pigeons, herons, ducks, geese and other kinds of birds. Protection methods contemplated include the establishment of game sanctuaries on the mainland and bird refuges on the "cays" or little rocky coastal islands, the stopping of unfair hunting practises, and the spreading of the gospel of conservation among the people.

PLUTO, the planet which was discovered by Lowell Observatory astronomers in 1930 beyond the orbit of Neptune, is probably very similar in size to the moon, whose diameter is 2,160 miles. Dr. Walter Baade, of the Mount Wilson Observatory, Pasadena, Calif., has compared the brightness of Pluto with that of Triton, the satellite of Neptune. This moon is known to be about the same size as ours, and it appears even in the telescope as a point of light, like Pluto. He has found that Triton is about a fifth of a magnitude brighter than Pluto, a very slight difference, and therefore concludes that they are similar in size. Pluto's average brightness is of magnitude 15.41, and when it is most brilliant it is only 14.14, much too faint to be observed with any but the largest telescopes.

ELEPHANTS appear to be safe from extermination, at least for the present, in the Uganda Protectorate, the wild upland territory that lies in the heart of tropical Africa, north of Lake Victoria. The report of the game warden for that region indicates that these great animals are at least twice as numerous now as they were 25 years ago. Increases have also been noted in the hippopotamus herds, and the buffalo seem to be holding their own. Lions are numerous and in some instances aggressive. There are more gorillas in the Kayonsa Forest than had previously been estimated. It had been thought that the gorilla population had dwindled to not more than thirty animals; now there appear to be about eighty.

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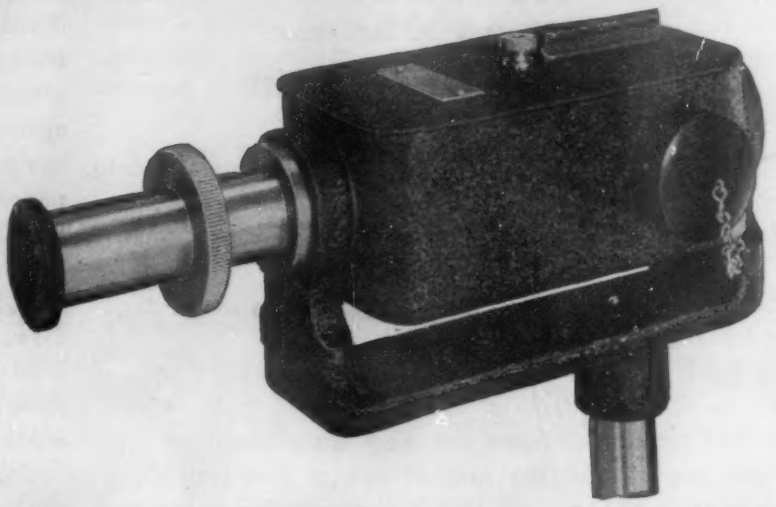

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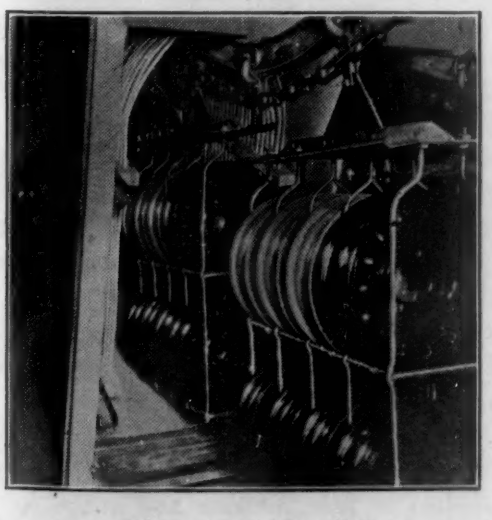

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SCIENCE NEWS

Science Service, Washington, D. C.

COSMIC RAYS

BY DR. ROBERT A. MILLIKAN

In an interview with Donald Caley,
Science Service Correspondent

THE theory of the convertibility of mass into radiant energy has been called upon by astronomers for at least thirty years, because they see no other way to account for the enormous quantities of heat given off by the stars during the aeons during which we have evidence that they have been existing.

In 1905 Einstein set up the equation, energy equals mass times the square of the velocity of light, which gives the relation between the mass transformation into radiant energy and the radiant energy resulting from that transformation. All this is the orthodox astronomical theory of present-day astronomers. Similarly when we found the enormous energy of the individual cosmic rays we could see no reasonable way of accounting for these energies except by this same transformation of mass into radiant energy, and when I made my first estimates I could see no other mechanism through which such energies could be obtained, save through such transformation of mass into radiant energy. From the known mass of the hydrogen atom and the known masses of helium, or oxygen, or silicon, we could compute, with the aid of Einstein's equation, the amount of energy to be expended in an individual cosmic ray if it originated in the act of the building up of an atom of one of these common heavy elements, oxygen or silicon, for example, out of hydrogen.

This had to be a change in which matter was converted into radiant energy, for the simple reason that sixteen atoms of hydrogen are actually found to weigh more than one atom of oxygen and yet we know that these sixteen atoms of hydrogen have gone into the building up.

And I have been repeatedly pointing out for the last six years or so that my estimated energy of the chief component of cosmic radiation is of the right order of magnitude to correspond to this kind of an origin. Some have called this building up of the common elements out of hydrogen a creation of matter, though as far as I know I myself have never used that phrase.

In other words, the transformation of mass into radiant energy through the building up of the common elements out of hydrogen (which in my London paper I have called the partial annihilation of matter) is one and the same thing with what some have chosen to call the creation of matter.

There is one other suggestion as to where the energy of the cosmic rays comes from, which I have always thought untenable but which has seemed to be rendered particularly untenable by these recent experiments; so that when I say that the only cause of the cosmic rays that is yet in sight is some form of the annihilation of matter—that is the transformation of mass into radiation in accordance with the requirements of the Einstein equation—I am only reiterating the view to which I have been giving expression whenever I have speculated at all about the origin of cosmic rays. The apparent rough agreement between the estimated energy of the chief component, which is actually the least penetrating component, and the energy computed from the theory of the building up of one or another of the common elements like oxygen, silicon or iron out of hydrogen, is the only bit of evidence that we have had in confirmation of this view. This evidence is just as good to-day as it ever has been; indeed, our new experiments have given us more certainty than we have had heretofore of the energy contained in this chief component of cosmic radiation.

Our newer experiments have also brought forward convincing evidence of the existence of cosmic ray energies very much higher than those of this chief component, concerning the value of which we have heretofore been in ignorance.

We now know that there are some very penetrating components of the rays which have energies higher than those that can correspond to any such transformation of mass into radiant energy as occurs when the heaviest elements that we know anything about are assumed to be suddenly formed out of the process of suddenly building them up out of hydrogen.

There has been some discussion in the past as to whether the cosmic rays might not be produced by the complete annihilation of hydrogen atoms instead of by the partial transformation of mass into radiant energy that is involved in the building of heavier elements out of hydrogen.

I have stated in the past that this process of the annihilation of hydrogen was, in my judgment, inadequate to account for the cosmic rays, as it would furnish an energy larger than that required to account for the chief component, which represents actually something like ninety per cent. of that part of the ionization of the atmosphere that is due at all to cosmic rays. Thus I have seen no reason in the past for assuming that this process was going on where the cosmic rays seemed to be coming from—namely intergalactic space—although I have followed the speculations of most modern astronomers in assuming that this process was going on in some way inside the stars.

Our new measurements on the energies of the most penetrating component of the cosmic rays, however, directly made in our laboratory, have revealed the existence of cosmic ray energies as high as six billion electron volts, and our discovery of the fact that a few electrons come in from outside and strike the earth in the equatorial belt—this is what we all agree produces the so-called latitude effect in cosmic rays—has made it necessary to assume that some of the incoming rays have energies as high as or possibly higher than ten billion electron volts.

Energies of that sort are far higher than those that

can be obtained by the process of building up any of the heavier elements out of hydrogen; indeed ten billion electron volts is an energy coming close to that which—in accordance with Einstein's equation—would be produced by the complete and sudden annihilation of a whole atom of carbon; and if, as is at least possible, some of these enormously powerful rays have energies as high as sixteen billion electron volts that would correspond to the total energy that would be transformed from matter into radiant energy if the complete atom of oxygen were suddenly completely annihilated.

That such a complete annihilation of the whole of the atom can take place all at once will be doubted by many physicists and astronomers and I am far from asserting that it does. But it is nevertheless true that there is no other tenable source of energy in sight that will yield the cosmic ray energies which we actually observe. One can take this merely as being in evidence of the depths of our ignorance of how these cosmic rays do originate, or if he is so inclined he can take it as evidence that such annihilating processes actually take place. I was merely pointing out to a group of physicists centered in London that so far as I can see there are no other alternatives now in sight.

My whole presentation of evidence in the past has been based, as I have repeatedly stated, on the validity of the Einstein equation and the fact that this equation when applied to the building up of helium, oxygen, silicon and iron seemed to give energies close to those found in the chief components of the cosmic rays; though within the last two years we have been using the Einstein equation to compute the energies imparted to the helium atoms which we actually prove are produced when the nucleus of a single hydrogen atom—the proton—enters a lithium atom.

This is the case where we are creating two new atoms out of the interaction of two other atoms, and we have actually found cases in which heavier atoms have been produced, in this way, out of the union of two other ones. In other words, we are doing in our laboratories the same processes as those whose existence I have been assuming. By these processes we have now produced gamma rays of twelve million volts—four times higher than any gamma rays that come off radioactive substances.

The energy to be expected when matter is transformed into radiant energy is more firmly established than before by these terrestrial experiments on transmutation.

ITEMS

SODIUM MONOXIDE, rarely prepared as an academic curiosity, proves to be readily available as an intermediate in peroxide manufacture. Known also simply as sodium oxide, it is described as a "super-caustic" which exceeds even caustic lye in chemical vigor. In the form of a dry powder it acts first as a powerful desiccant, or artificial drying agent. It virtually tears water out of most organic matter, and is thereby transformed into highly concentrated lye, or sodium hydroxide. This dehydrating process is attended with production of heat. As a result the normal action of the lye is accentuated, and speedy chemical action assured. In the manufacture of the new product metallic sodium is permitted to combine with oxygen in a restrained fashion, yielding a compound somewhat analogous to the rust of iron, but much more active chemically. In view of the ability of the new oxide to attack not only common vegetable and animal matter, but metals, solvents and a host of organic chemicals related to the dye, lacquer, drug and other industries, especially when in the molten state, a wide interest is being taken in its industrial future.

PROTEIN in the leaves of various plants depends on the amount of sunshine the plant receives, according to Professor Teru Fujita, of the Kyushu Imperial University. According to the results obtained from growing plants under various thicknesses of cheesecloth, and a subsequent analysis of the leaves, the more light the plant receives, the greater the amount of protein it forms. The same relations probably hold, states Professor Fujita, during day and night, the protein decreasing during the dark hours.

A NEW method of feeding vegetables to babies as young as three months of age has been tested clinically by a New York physician, and it now appears that mothers may soon be having vegetable formulas for infants as well as the old accustomed milk formulas. The tests with feeding green and yellow vegetables successfully to 70 infants between three months of age and one year were reported recently before the American Dietetics Association in Washington, by Dr. George W. Caldwell, of New York. The method tested by Dr. Caldwell consists of homogenizing the vegetables. This process explodes particles of the food during its preparation so as to release nutritive elements and make the food easier to digest.

RUSSIAN farmers have discovered a way to speed up the ripening of their cotton crops by a month or more. They use coal to warm the cotton plants without burning the coal. This seeming paradox is being performed at Kazakstan. Obtaining heat from coal without burning is the application of a simple fact of physics that dark colors absorb the heat in the sun's rays better than light colors. The Kazakstan farmers simply spread coal dust lightly over their fields; about 100 pounds to an acre. The darkened surface of the land is a better absorber of heat during the day and re-radiates more of it as warmth during the night. The higher average temperature of the land during the growing season, therefore, shortens the time necessary for the crop to mature by over a month.

SNOW in the woods, valuable source of stream-water during the ensuing summer, is caught most efficiently by hardwood stands, but held best against the melting effects of spring sun and wind by white pine. These, in closest condensation, are the high points of snow-sampling experiments performed in various types of Connecticut woodland by W. L. Maule, of the U. S. Forest Service. Mr. Maule's results will be stated in detail in a report which will be published in the October number of the *Journal of Forestry*.

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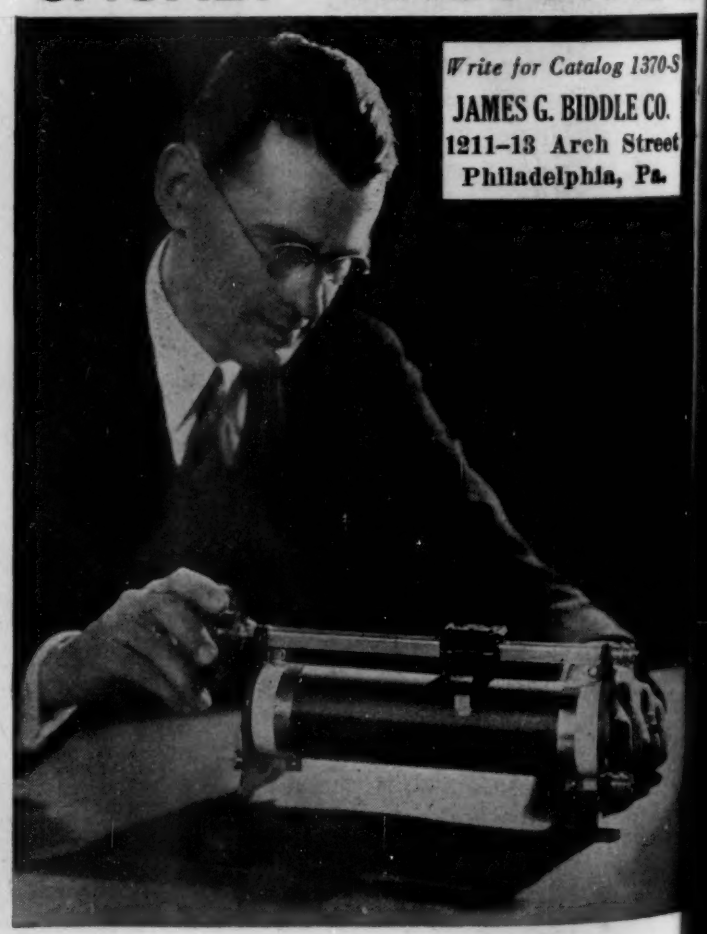

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SCIENCE NEWS

Science Service, Washington, D. C.

THE USEFULNESS OF LABORATORY RESEARCH

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UNPREDICTABLE by-products of research in physiology are rarely brought to the attention of the layman. The studies which led to the appreciation of liver as a food to promote hemoglobin regeneration were taken up with no idea of any clinical application. We wished to find out how the body built up hemoglobin and what materials could best be utilized by the body.

These studies are still being carried forward to determine what elements of food are most essential to make new hemoglobin. Dogs are best suited for these studies and all work has been done on these animals. They are frequently used to standardize liver fractions to be used in the treatment of human disease.

Future progress in the control of other diseases can not be predicted with any certainty but if history has any significance it points to future by-products coming from investigations in the wide field of pure science which will enable the physician to bring under control still other diseases which afflict human kind.

It is never safe to state that any bit of accurate knowledge about body physiology is useless for in the future some student may sense its application to the study of some particular disease state. Progress is often made by way of detours which look very unfavorable at first.

GEORGE H. WHIPPLE

UNIVERSITY OF ROCHESTER

THE CONQUEST OF PERNICIOUS ANEMIA

ONCE when a doctor shook his head and said "pernicious anemia," it was a death warrant executed in two or three years by the slow progress of this blood disease. In 1926 the medical world was thrilled, as it is occasionally by some great advance, by reports from the Harvard Medical School that liver, the ordinary calf or beef liver of that tasteful liver and bacon dish, was capable of conquering pernicious anemia. To-day the disease fighters who made mankind unafraid of one more disease are honored for their work by that highest of science's awards, the Nobel prize in medicine.

As insulin subdued the toll of diabetes, so liver is a specific for pernicious anemia. And as the achievement of insulin was crowned by a Nobel award to the group responsible, so liver for anemia is now recognized.

Like many great discoveries in science, the conquest of this disease of the bone marrow, a disease that prevents the formation of enough vigorous red blood cells, came slowly. The first act occurred in the animal experiment laboratories of Dr. George H. Whipple, of the University of Rochester. The second act of the drama came when Dr. George R. Minot, of Harvard Medical School, seized upon Dr. Whipple's results and reprieved by the grace of science pernicious anemia patients.

It seemed simple after it was done. The patient ate large quantities of liver—as much as half a pound a day. That is, it was simple if the patient happened to like liver, which most of them did not. Since then the treatment is dietetically less heroic for the material in liver that does the work in counteracting the disease has been extracted and it is only necessary for the patient to take relatively small doses of the extract. But in the early days, the patients ate liver and they had to like it. One incidental effect when the news got around was that perfectly well people who did not need to eat liver to save themselves from death decided to eat more liver. And the price shot upward under increased demand which did not help the economics of combating the disease.

Within the first four years after announcement of the treatment in 1926, life insurance statisticians found that the mortality from this disease for white persons had been reduced by about half between the ages of 55 and 74 years, in which range formerly the heaviest mortality from this disease had occurred. At the same time, pathologists in medical schools were finding themselves hampered in their teaching because they could not find a sufficient number of patients suffering from the disease to be used in showing medical students how this disease affects the body!

Perhaps it was because he suffered from diabetes and thus learned first-hand the vital importance of scrupulous attention to diet that Dr. Minot discovered the value of liver in treating pernicious anemia. According to reports it was while he was weighing every morsel of his own food, before the discovery of insulin, that he began to investigate the eating habits of his pernicious anemia patients. He found them finicky eaters, over-fond of fats and disliking meat and other protein foods. Then he heard of Dr. Whipple's laboratory experiments.

Dr. Whipple had given dogs another kind of anemia—simple anemia—and had found that feeding liver or muscle meat cured their anemia. Dogs do not get pernicious anemia, and the two kinds—simple and pernicious anemia—are quite different. Furthermore, muscle meat such as beefsteak had never helped pernicious anemia patients. Still, Dr. Minot decided to give liver a trial, perhaps spurred on to this decision by the knowledge that liver was being found valuable in pellagra and sprue, two diseases which had certain similarities to pernicious anemia.

The striking improvement in the first liver-fed pernicious anemia patients seemed too good to be true, so Dr. Minot enlisted the unprejudiced aid of another practicing physician, Dr. William P. Murphy, of Harvard Medical School. Without telling Dr. Murphy much about his own results and hopes, he persuaded the latter also to try liver feeding for pernicious anemia. When Dr. Murphy's liver-fed patients showed the same striking improvement, Dr. Minot felt sure enough of the method to make the first public announcement at a scientific meeting.

SEARCH FOR AN ANTI-INFLUENZA SERUM

(Copyright, 1934, by Science Service)

AN anti-influenza serum has been produced in a horse by the three British investigators who last year isolated the influenza virus. The same scientists have found a way of systematically using mice, the most widely available animals for medical research, for their intensive experiments in the long-continued war against flu.

This dual announcement is made in the current issue of *The Lancet*. The three scientists are Drs. C. H. Andrewes, P. P. Laidlaw and Wilson Smith, all of whom are working at the National Institute for Medical Research Farm Laboratories, at Mill Hill, a suburb of London.

Dr. Laidlaw was last November awarded the Royal Medal of the Royal Society of London for his part in discovering a vaccine for protecting dogs from distemper, which is believed to be the canine counterpart of flu. The isolation of the influenza virus reported last year, since confirmed in America by Dr. R. Shope, of the Rockefeller Institute at Princeton, N. J., resulted from their having previously discovered that ferrets are susceptible to infection with human influenza.

The extreme importance of this discovery was due to ferrets being the first animals in which systematic infection with human influenza was shown to be possible. Before last year it had seemed to many investigators that the only way to tackle the flu problem thoroughly was to call for human volunteers, who, living for the time as laboratory animals, would allow themselves to be deliberately infected with the disease so that its cause, cure and prevention might be intensively studied, and who might, of course, die. Earlier experiments with apes and monkeys had occasionally given hope that these animals might be used for this purpose, but further trials had proved that results were negative more often than not, and that certainly no dependability of response to infection could be expected.

Rapid progress has followed the use of ferrets. What is at present its zenith is referred to in the current *Lancet* report quite briefly only. Drs. Andrewes, Laidlaw and Wilson Smith state that five mice given mixtures of virus and undiluted serum—the serum from a horse which had been hyper-immunized with tissue from ferrets that had been infected with a strain of human influenza—survived, while five controls all died. Last year's discovery enabling ferrets to be infected with flu was an essential step in the obtaining of the serum from a horse.

Details concerning this horse serum will be published later. For the moment medical men and laymen alike have to wait as patiently as possible for the promised full account of what may prove to be one of the most important medical advances for many years.

A NEW PITUITARY GLAND PRODUCT

(Copyright, 1934, by Science Service)

DISCOVERING a new hormone from the body's master gland, science may have a clue to the cause of stomach ulcers. The new product of the pituitary gland seems to stimulate the stomach to pour out increased amounts of hydrochloric acid. This discovery has just been made and reported by scientists at the Courtauld Institute of Biochemistry of the Middlesex Hospital of London.

It may mean that it will be found that a disorder of the pituitary is the cause of stomach ulcers. Excess hydrochloric acid is found in cases of stomach ulcers. This excess acid is believed by some scientists to be a cause or part of the cause of this condition. The London discovery also ties in with the finding of an American scientist, Dr. Harvey Cushing, that stimulating the base of the brain near where this gland is located may produce stomach ulcers.

The new glandular product comes from the hind part of the pituitary gland. It was discovered by Drs. E. C. Dodds, R. L. Nole and E. R. Smith. With characteristic scientific reserve and caution, they report in the current issue of *The Lancet* that their findings "suggest the probability of a new posterior pituitary hormone." They call it a "factor."

They think they have discovered either a new hormone or a new, hitherto undiscovered property of an already known pituitary hormone which affects blood pressure. The editor of *The Lancet* considers the new substance more likely to be an entirely new hormone.

In their investigations a special extract from the hind or posterior part of the pituitary gland was injected under the skin of forty rabbits. This produced marked injuries in the fundus or acid-producing area only of the stomachs of all the rabbits. The same effect was obtained when the rabbits were fed very large doses of the standard posterior pituitary extract prepared according to the directions of the British Pharmacopeia.

The doses given both by mouth and by injection under the skin were so large that the newly-discovered factor that injured the rabbits' stomachs would appear to be negligible in the ordinary doses of posterior pituitary prescribed for patients. What effect the new hormone has on the body in the small quantities normally produced by the pituitary gland is not yet known with certainty.

CORNELL EXPEDITION TO THE NORTH-WEST COAST AND THE PTARMIGAN CHICK

BY DR. FRANK THONE
Science Service Editor in Biology

THE first "Eskimo chicken," or ptarmigan, ever to be raised in captivity was described before the Chicago meeting of the American Ornithological Union, by Professor A. A. Allen, of Cornell University. Although now living far to the south of any country known to ptarmigan, at least since Ice Age times, this friendly little bird of the Arctic has adapted itself well to its environment, and has not presented any infancy troubles beyond those shown by the more familiar ruffed grouse, which has already been raised in captivity by Professor Allen.

The bird is now changing into its winter white coat of feathers, and is at present in a sort of half-and-half uniform—dark summer plumage above and winter white underneath. Moulting in this species differs from that

in other birds in that it seems to be a continuous process throughout the year.

The rearing of this ptarmigan chick on the Cornell University campus was one result of a three-thousand mile expedition to Churchill, Manitoba, on which Professor Allen was sent last June, under the auspices of the Grouse Investigation Committee of the American Game Association, to further the studies of the ruffed grouse which he has been making for many years.

On the expedition a high spring mortality among the ptarmigan was noted, and an almost complete disappearance of lemmings, small animals of the rabbit-squirrel family. Professor Allen would not undertake to pass on the causes of these seeming fatal plagues however, until pathological specimens collected at the time can be given careful study.

At the same session one of Professor Allen's colleagues reported on other phases of scientific bird study. Dr. George Miksch Sutton, curator of birds at Cornell University, told of the work of a joint expedition to the Vancouver Island region, on the coast of British Columbia, undertaken by the university and by the Carnegie Institution of Washington. After several weeks of work in the coastal straits and inlets, the party, known officially as the John B. Semple Ornithological Expedition, moved inland over the mountains and into the drier country.

Two outstanding achievements of the expedition were the collection, for the first time in forty years, of the first positively identified and perfect egg of the marbled murrelet, a small water bird, and the collection of a black pigeon hawk.

Dr. Sutton reported a wanton slaughter of bald eagles by the Siwash Indians, who sell the wings for a dollar apiece and the tails for fifty cents. These trophies find their way southward and inland, being used by the Plains Indians and the Pueblos and Hopis of the Southwest for the "millinery" the braves still affect. By the time the feathers reach the Pueblo-Hopi country, in the hands of white traders, they are priced at a dollar each. Dr. Sutton also called attention to the need for better-enforced protection for the rare trumpeter swan in the Knight's Inlet region, which are being mercilessly hunted.

ITEMS

SOUND reflectors, similar in principle to those used by military forces to detect approaching airplanes, are given much more peaceful employment by Paul Kellogg, of the laboratory of ornithology at Cornell University. Before the meeting of the American Ornithological Union in Chicago, he demonstrated how he has been using a highly directional parabolic reflector with an exceedingly sensitive microphone at its focus, to capture the songs of birds in the field, and give them permanent phonographic recordings.

MORE than a million marshes and small lakes spread over the vast uncultivated northern wilderness of Canada, constitute this continent's last great breeding-ground and refuge for ducks, geese and other wild-fowl of the waters. A survey of this "duck-heaven" was presented before the meeting of the American Ornithological Union at Chicago by Edward A. Preble of the U. S. Biological Survey. In pre-settlement days, Mr. Preble said, wild-fowl bred as far south as Iowa. Then came farmers who plowed and drained, hunters who shot recklessly, first over the prairies and plains of the United States, finally far up into the great grasslands of Canada. Now the ducks must make long flights, from northern Canada to the Gulf Coast region, and the wild-fowl problem is a major job of international adjustments.

A NEW way of fighting peritonitis, the often fatal infection which may follow abdominal operations, was demonstrated to surgeons attending the clinical congress of the American College of Surgeons in Boston by Dr. Edward L. Young, surgeon-in-chief of Faulkner Hospital and on the surgical staff of Massachusetts General Hospital. By this method death following surgical removal of part of the digestive tract was reduced from 30 per cent. to 2 per cent. The method was originated by Dr. Herbert L. Johnson, of West Roxbury and Boston. It consists of injecting into the abdomen what Dr. Young called a "concentrated fraction of bovine amniotic fluid." At first it was used at the time of operation but now is injected four to six hours before. This fluid, now obtained from cows at the time their calves are born, apparently has the power to stimulate healing in the abdomen and resistance to infection.

CASES of skin cancer caused by arsenic-containing medicines taken for other conditions have caused Drs. Clifford C. Franseen and Grantley W. Taylor, of Boston, to issue a warning to physicians to be cautious in giving arsenic as medicine. Nine cases definitely due to arsenic and five more cases probably caused by arsenic are reported by them in the current issue of the *American Journal of Cancer*. In two of the cases, the patients had been exposed to arsenic in the form of a spray for fruits and vegetables. But arsenic given as medicine for the relief of skin diseases and blood disorders caused the cancerous condition in the majority of the cases.

SUGAR made from wood will not be a positive contribution to Germany's economic recovery, but the exact opposite, declares Professor O. Spengler, director of the Institute for the Sugar Industry, with headquarters in Berlin. Wood can be turned into sugar on a large scale by the well-known Bergius process, he admits; it can even be done at a financial profit. Professor Spengler's contention in opposition is based more on what he claims is wood's lower food productivity per acre as compared with the yield of sugar beets. According to his figures, one hectare (about 2½ acres) of land in sugar beets will support 20 persons, under German conditions of cultivation. The same area in potatoes will support 10 persons, in wheat only 6. He does not give figures of the supporting capacity of land in trees destined to become sugar, but implies that it is even lower than that of wheat acreage. He contends, therefore, that to substitute wood sugar for beet sugar in Germany would aggravate the already troublesome agricultural unemployment problem. Professor Spengler's figures and arguments are given in detail in the German science journal, *Die Umschau*.

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*McKhann, Charles F., and Chu, Fu Tang: Use of Placental Extract in Prevention and Modification of Measles, *Am. J. Dis. Child.* 45:475, 1933.

McKhann, Charles F., and Chu, Fu Tang: Antibodies in Placental Extracts, *J. Infect. Dis.* 52:268, 1933.

McKhann, Charles F., and Coady, H.: Immunity in Infants to Infectious Diseases: Placental Antibodies, *Southern Med. J.* 27:20, 1934.

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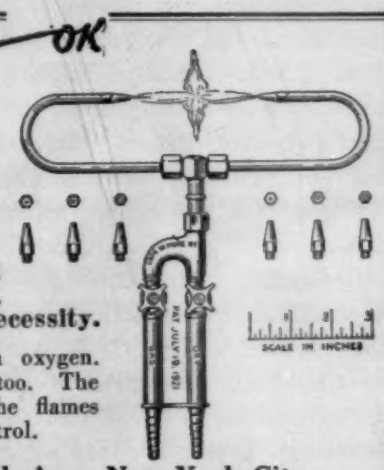

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SCIENCE NEWS

Science Service, Washington, D. C.

LIVER THERAPY FOR PERNICIOUS ANEMIA

BY DR. WILLIAM P. MURPHY

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IT gives me great pleasure to have this opportunity to briefly comment upon the work in which Dr. Minot and I have cooperated during the past ten years, and for which we have received the highest honor which it is possible for a physician to receive—awarded by the Nobel Prize Committee of the Caroline Institute of Stockholm, Sweden.

Since our initial work on the treatment of pernicious anemia by the use of liver, as carried out in our office practise and at the Peter Bent Brigham Hospital and the Collis P. Huntington Hospital in Boston, much progress has been made in the direction of improvement and simplification of treatment of the unfortunate victim of this disease.

Although the amount of liver necessary for each patient's needs may vary greatly it is necessary for him to take daily an average of from one fourth to one half pound, or during each month a total of eleven pounds in order to keep well. If instead of taking liver the patient is advised to take a potent liver extract by mouth it will be necessary to use daily three vials or doses and in a month eighty-four vials or doses in order to replace the effect of the liver. The average cost of eleven pounds of liver will be about $5.50, whereas the cost of the eighty-four doses will be approximately $17.00.

Contrast the difficulties and expense of such a regimen with that which is now possible through the development at the Peter Bent Brigham Hospital with the cooperation of Dr. Guy W. Clark, of the Lederle Laboratories, of an extract of liver which may be injected into the muscle and which is so concentrated that it is necessary to use only one injection to replace the eleven pounds of liver or eighty-four doses of liver extract if taken by mouth. And this concentrated extract for intramuscular injection costs but $1.20.

Is not such a saving worth while at a time when each and every one of us feels the need for the greatest economy? If one is to realize that treatment by means of this material costs even less than does the liver, is more effective in controlling the disease and is so much more convenient to take, I am sure that we can all agree that progress in the direction of simplification of treatment for patients with this disease is being made.

Let us consider the evidence that progress is being made in the control of this disease as judged on another basis.

The Metropolitan Life Insurance Company has recently compared the death rate from pernicious anemia for the period since 1926 when liver treatment came into general use with a like interval before 1926 when this treatment was not available. They observed that the death rate in individuals with pernicious anemia between the ages of 30 and 50 years has been only half so great since the use of liver as it was before. Above the age of 50 the death rate has not shown such a striking decrease, no doubt owing to complications which are more likely to occur during the older age period.

I feel sure that the death rate will be further reduced and that there need be no deaths from this disease if each patient will continue to take regularly in some form an adequate amount of liver substance as prescribed by his physician. The amount of liver substance necessary must be determined on the basis of regular determinations of the number of red blood cells and the patient's physical condition. It is our hope that even further progress in this direction will be made as others continue to take up the problem with us.

SODIUM AS A SOURCE OF GAMMA RAYS

DISCOVERY of a way to make the common element sodium give out the most penetrating gamma rays by artificial means has recently been announced at the University of California. The radiation, it is believed, will have great usefulness in medicine for the treatment of diseases like cancer and in a study of how radiation acts on living tissue. Professor Ernest O. Lawrence who made the discovery, in reporting his results to *The Physical Review*, writes: "In the biological field radio-sodium has interesting possibilities that hardly need be emphasized here."

Sodium is one of the constituents of familiar table salt and occurs in certain of the fluids of the human body. Saline solution, for example, can be injected into the blood stream of the human body without disastrous effects. The new gamma radiation produced in Professor Lawrence's laboratory from sodium is more penetrating than any ever before obtained. Sodium gamma-rays have energies of 5,500,000 electron volts. Most penetrating of the naturally produced gamma-rays are those of thorium C″ (thorium C double prime) having energies corresponding to only 2,600,000 volts. Most powerful and penetrating of the hitherto man-made gamma-rays are those created by Drs. C. C. Lauritsen and H. R. Crane, of the California Institute of Technology, from carbon. The carbon gamma-rays had energies of 3,500,000 volts. Professor Lawrence's radiation, therefore, exceeds the previous records for gamma-rays produced both naturally and artificially.

More important still, from the standpoint of possible medical uses as in cancer therapy, the radio-sodium gives out its rays for a long time. The half life of the substance is fifteen hours, that is the original amount disintegrates to half in this time. Most of the elements with which artificial radioactivity has been produced do not last nearly as long. Two hours has been a long time hitherto; a few minutes of activity is the general rule.

Professor Lawrence creates his artificially radioactive sodium by bombarding sodium with deutons, the charged nuclei of the new, heavy hydrogen. These deutons are shot at the sodium with energies of 1,750,000 electron volts. Besides the very penetrating gamma-rays, beta-rays or electrons come off from the radio-sodium. This

indicates, Professor Lawrence suggests, that the radioactive substance is a form of sodium which distintegrates into magnesium. Chemical tests confirmed this suggestion.

The way gamma-rays from sodium are absorbed in lead suggests, that the radiation emitted is probably all of one wave-length, or monochromatic, which would make the new radiation extremely useful in physical experiments.

Professor Lawrence points out "that many uses of radio-sodium will probably be found. In the physical laboratory it provides a presumably monochromatic source of high energy gamma-radiation of great intensity. In the biological field radio-sodium has interesting possibilities that hardly need be emphasized here."

Drs. Edwin McMillan and Malcolm C. Henderson collaborated with Professor Lawrence in the radio-sodium experiments.

THE TEMPERATURE OF THE STRATOSPHERE

FURTHER proof that the layers of ionized atmosphere of the earth from 62 to 124 miles above sea-level have a fairly constant temperature regardless of the time of day, night or season is presented in a report to *The Physical Review* prepared by Dr. E. O. Hulburt, of the Naval Research Laboratory.

Moreover, new data taken by many investigators scattered all over the world indicate that the temperature of the high altitude layer may be as great as that of an average summer's day at the earth's surface, about 80 degrees Fahrenheit.

"Best agreement between the radio facts and the theoretical calculations is found," Dr. Hulburt reports, "if the temperatures of these levels is taken to be rather warm, above 300 degrees Kelvin." A degree Kelvin is the unit on the absolute temperature scale. A figure of 300 degrees Kelvin corresponds to 80.6 degrees Fahrenheit.

Dr. Hulburt's preliminary report was prepared from data forwarded to him by investigators working at the Department of Terrestrial Magnetism of the Carnegie Institution and the National Bureau of Standards, both of Washington. Observations were obtained in such widely scattered places as Watheroo, Western Australia; Huancayo, Peru; Washington; Fairbanks, Alaska; and in New England and Nova Scotia during the solar eclipse.

Taking advantage of the reflection of radio signals from the ionized layers scientists have further investigated the characteristics of the layer known as F2. This layer of the ionosphere begins about 145 miles above sea-level and continues up to 220 miles. Layer F2 is above the layers E and F1 whose temperature varies within 86 degrees Fahrenheit no matter what the time of day or season.

Radio studies of the ionization in the F2 regions for different times of day, Dr. Hulburt indicates, fit in with the belief that great waves of ionized atmosphere move about in this region. As the ionized air spreads out from a point directly below the sun in all directions, part of it moves with the rotation of the earth and part against the rotation. Eastward the ionized wave moves with the earth and should be like the case for water waves—of a smooth form, perhaps like ground swells. The part of the wave going westward moves against the earth's rotation and, Dr. Hulbert postulates, "is checked and is caused to whitecap, as in a tide rip." That is, the top spills over the bottom of the wave.

Observations made on the magnetic equator substantiate this view and record a greatly disturbed and erratic layer of ionization in the morning hours with a maximum at 10 A. M. A minimum occurs at noon and then there is a smoother, less disturbed ionization in the afternoon with a broad maximum at from 6 to 8 P. M.

NEW REFINING PROCESS FOR LUBRICATING OIL

A NEW method of oil production which is claimed to make it possible to obtain standard, even quality oil from many types of crude petroleum, either high or low grade, was demonstrated by engineers of the Socony-Vacuum Oil Company on October 31 at their new refineries at Paulsboro, N. J.

At a private showing of the new plant for automotive engineers and scientists from New York, Philadelphia and Washington it was demonstrated that the new process is based on physical happening rather than the older chemical method of using sulphuric acid. Impurities in the crude petroleum are separated from the desired products as one would separate sand from sugar in a mixture. Water poured on the sand and sugar would dissolve out the sugar leaving behind the sand.

In the new oil refining process solvents act in somewhat the same way. One type of solvent acts by excluding from the oil those substances which tend to form carbon in the gasoline engine. Another type of solvent has comparatively little effect on the carbonizing characteristics of the oil, but is effective in removing those substances which break down at high temperatures developed within gasoline engines.

Engineers of the company maintain that hundreds of thousands of miles of actual road tests show the oil made by the new method will last twenty-five per cent. longer than the best of present-day oils. Formation of carbon in the engine is likewise prevented together with the removal of fear of sticky valves and piston rings.

The new method allows the often dangerous use of sulphuric acid in oil refining to be completely eliminated. So rigid is the control of the solvent process that crude oils from cheap Texas types to the superior Pennsylvania oils can be used with equal success. When the quantity of solvents is "adjusted" to the particular crude oils available a standard high-grade product can be obtained. So mechanized is the plant that three engineers alone can control the production of 2,000 barrels of the new oil a day.

Tests on the viscosity, or flowing qualities, of the new oil reveal that it flows more freely at far below freezing temperatures and yet keeps its body at the high temperatures encountered within the engine.

THE EFFECT OF DIFFERENT WAVE-LENGTHS OF LIGHT UPON THE GROWTH OF PLANTS

WHEN plants in a window-box, or potato sprouts in a dark cellar bend toward the light as they grow, they are not responding equally to all the colors in that great mixture of lights we call white light. Toward red light they will not bend at all, while on the other hand there are certain wave-lengths in the blue region of the spectrum, toward which they are especially sensitive.

Recent researches at the Smithsonian Institution, reported before a Washington botanical audience by Dr. Earl S. Johnson, have picked out very sharply the particular wave-lengths that are most potent in stimulating plant bending. The most effective of all light wave-lengths is a very narrow band in the neighborhood of 4,400 Angstrom units, which is in the blue part of the spectrum. From this point the effectiveness of light in producing bending falls off rapidly to a point near 4,600 Angstrom units, which is still in the blue region. Then it rises again to a secondary peak at about 4,750 Angstrom units, a slightly greenish blue, and then drops to an "almost-no-effect" point beyond 5,000 Angstroms, in the red.

In carrying out his experiments, Dr. Johnson used plants themselves—young oat seedlings—as pointers. At one end of a long, darkened box was a standard lamp. At the opposite end was another lamp, with suitable filters to permit only light of the desired wave-lengths to pass through. The seedlings were placed between these lights, and permitted to "choose," indicating the light having the greater effect by bending toward it.

The standard lamp was moved back and forth, until one of the seedlings indicated "no choice," showing that the two light sources were in balance. Then a sensitive light-measuring instrument was substituted for the seedling, to obtain the relative amounts of energy put forth by the two lights. In this way a sensitivity curve for the effectiveness of all parts of the spectrum was built up, based on the "choices" of many hundreds of seedlings—for any given seedling could be used for only one exposure.

Full details of these experiments, with their background of earlier researches by other workers, will be published at an early date by the Smithsonian Institution.

ITEMS

BALUCHITHERIUM, a giant rhinoceros and the largest land mammal that has been discovered thus far, is being assembled for exhibition at the American Museum of Natural History. Professor W. K. Gregory and Dr. Walter Granger, of the museum, in a report to the American Society of Mammalogists, described their work on the restoration of this great creature of more than 30,000,000 years ago, which stood over thirteen feet high at the shoulder. Parts of over twenty-five individuals, collected on the museum expedition to Mongolia, are being sorted and pieced together to make a restoration that will look very different from the only other in existence which is in a Russian museum in Leningrad.

A NEW process which makes possible durable photographs on metallic plates of aluminum and its alloys has been culminated by the firm of Simens and Halske A.-G. in Berlin. For many years it has been known that aluminum and its alloys would attain oxide films which would absorb with avidity solutions of pigments and thus attain brilliant color effects. The new method takes advantage of the porosity of such oxide films by having them absorb light sensitive substances instead of pigments. The aluminum sheets are dipped successively in solutions of aluminum chloride and silver nitrate and dried after each immersion. Other silver salts, iron salts and diazo bodies can also be used to make the metal plate light sensitive. Finished photographs made on metallic films are characterized by great durability because the film of oxide protects the underlying aluminum from chemical and mechanical influences. Such photographs, therefore, will resist the effects of light, water and weather.

"PROTIUM OXIDE," purest water yet prepared, practically free from "deuterium oxide" which contains the double-weight hydrogen variety, is lighter than the common drinking water by about 12 parts per million. Ordinary water contains about one part in 9,000 of heavy water, according to the investigators who carried out the extensive purification in connection with the work here described. E. H. and Professor C. K. Ingold, at University College, London, and H. Whitaker and Professor R. Whytlaw-Gray, at the University of Leeds, purified London and Leeds tap water by fractional distillation, electrolysis and decomposition with metals, until it contained at the most a few units per cent. of the original heavy water.

X-RAY motion pictures have dispelled a recent scare of thymus deaths among new-born infants, according to a report by Dr. Robert F. James, research physician of the Westinghouse Electric Company, on October 30, to the Society of Motion Picture Engineers meeting in New York. "X-ray photographs," Dr. James states, "disclosed a large shadow in the vicinity of the thymus, a ductless gland in the upper section of the chest. But none of these infants showed typical symptoms of the disease and subsequent x-ray pictures failed to show the shadow. The attending physicians who observed the shadow concluded that the penetrating x-radiation used in making the photographs checked the thymus enlargement. When continuous x-ray motion pictures were made, however, the shadow taken to be an enlarged thymus was found to be merely the shadow of the infant heart, coming and going with the pulse."

HALF a billion years ago, a series of ripples played over the shallow water at the beach-edge of a lake, in what is now the state of Arizona. One of the ripple-marks left by the water in the soft sand that day has just been identified as such, hardened into rock through long burial and pressure. The discovery of this well preserved water ripple mark in the Archean sediments of the Grand Canyon, a section of the world's oldest sedimentary rocks, has been announced by Drs. J. H. Maxson and Ian Campbell, of the California Institute of Technology. It has the distinction of being the oldest recorded fossil of its type in North America.

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SCIENCE NEWS

Science Service, Washington, D. C.

GENES AND CHROMOSOMES

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GENES, the tantalizingly elusive minute units that control our inheritance of such things as hair color and the shape of our noses, have been tracked down almost to their final lair by a scientific team consisting of an American, Professor H. J. Muller, of the University of Texas, and a Russian, Dr. A. A. Prokofyeva, of the Soviet Academy of Sciences' Institute of Genetics.

Professor Muller, on leave of absence, has been, during the past year, a research guest of the academy at Leningrad. The results which he and his colleague have attained to date were reported before the first meeting of the academy held at its new headquarters in Moscow.

Professor Muller and Dr. Prokofyeva have dealt with chromosomes, the minute sausage-shaped bits of living substances within the cell nucleus or center. These chromosomes have been regarded for many years as the abode of the genes although the exact distribution of the genes within them has never been accurately determined.

Now one of the outstanding results of the Muller-Prokofyeva research has been to trace known gene groups to definite locations within the chromosomes. They have made a much more exact map of their places of residence than has hitherto been possible. They have traced home to individual chromomeres the particular genes they singled out for study. Chromomeres are subdivisions of a chromosome only about one hundredth the size of the larger bodies.

The smallest bit of chromosome stuff with which Dr. Prokofyeva has worked had a diameter about equal to the shortest wave-length of visible light, which is sixteen millionths of an inch. Yet in or on that tiny particle there was room for several genes.

The two investigators hope that before long, they may be able to break off chromosome particles so small that they can contain only one gene apiece, and thus obtain a definite measure of the size of the individual gene.

The new attack on the secret of the chromosomes was made possible by two previous developments. First, by a method of inducing mutations or evolutionary changes in organisms through bombardment with x-rays, developed by Professor Muller some years ago. Second, by a new technique in staining chromosomes and mapping the gene locations on them, which was announced for the first time in December, 1933, by Professor Muller's colleague at the University of Texas, Professor T. S. Painter.

By bombarding the chromosomes with x-rays, and then studying the breaks and shifts in their minute structure thus caused, Dr. Prokofyeva was able to make a map showing where gene changes should be expected. At the same time, Professor Muller prepared another map, on a purely genetic basis, showing the locations of the gene changes. When the two maps were compared, they were found to correspond exactly, constituting a very nice case of mutual scientific support.

Sometimes the x-ray bombardment resulted in the dislodgment of a bit of chromosome carrying a few genes, which found its way to an entirely new place on the line-up and worked its way in, like a bird chased off a telegraph wire by a small boy's stone wedging itself into another roosting place without dislodging any of the crowded birds already there. Such newly-located chromosome fragments carry their genes into places where the interaction between the transferred genes and those already in place produce marked changes or mutations in the appearance of the resulting organism. The effect of a gene or gene-group thus appears to depend at least partly on is interaction with its neighbors, and not altogether on intrinsically possessed powers of its own. This "position effect" is a discovery that may be of very great importance.

Another result pointed out by Professor Muller is that in some cases it is possible for certain genes to become totally removed from the chromosome material without such loss killing the individual. Such "gene-deficient" individuals, however, do show abnormalities which may resemble the effects produced by mutations of the same genes.

Further research by Professor Muller and Dr. Prokofyeva is being pushed ahead energetically and full publication of the technical details of their work will eventually be made in both Russian and English.

SERUM FOR UNDULANT FEVER

TWENTY undulant fever patients quickly restored to health and normal activity by the use of a new serum constitute a record reported by a group of Cincinnati investigators to the American Society of Tropical Medicine meeting at San Antonio on November 14.

The serum was produced from goats after inoculating them with chemically treated suspensions of the organisms or "germs" that cause the disease. Drs. W. B. Wherry, A. E. O'Neil and Lee Foshay, of the University of Cincinnati College of Medicine and the Cincinnati General Hospital, are the group responsible for this advance in the fight against undulant fever.

The disease is a serious, long-drawn-out affair which may end fatally. It is caused by an organism known by various names, *Bacterium melitensis* being a correct technical title. Neuralgic pains, swelling of the joints, recurring attacks of fever, weakness and anemia are unpleasant features, and particularly unfortunate for the sufferer is the tendency for the disease to become chronic with frequent relapses and slow recovery.

Goats, cows and pigs suffer from the disease, and it is from these animals, particularly from unpasteurized milk of the first two, that man contracts undulant fever. The relation between the animal disease and the human disease and the value of pasteurization of milk as a preventive measure were established by Alice Evans, of the U. S. Public Health Service. In the course of her research she herself suffered a severe attack of the disease

Treatment of undulant fever has remained unsatisfactory until the development of the anti-serum. So far the serum has been given to only twenty-six patients. But the results, according to Dr. Foshay, in over two thirds of the cases have been "extremely gratifying" and the lack of success in six cases was partly due, he believes, to the fact that in the first cases the serum used was not strong enough or not given in large enough doses or given too late in the course of the disease. To be successful, it is important that the serum be given before the end of the fourth month of the illness. Delay in starting anti-serum treatment was responsible for some of the failures.

In the twenty patients who were benefitted by the serum, the fever stage was reduced from the usual weeks-long period to an average of only nine days. Other symptoms disappeared within from one to six weeks, with an average of fifteen days. The patients were able to resume their customary activities in from eight days to two months, with an average of three weeks. They have been free from relapse for periods ranging from four months to twenty-nine months, or over two years. The success with this serum has encouraged the scientists to try to produce from the horse a more powerful and reliable anti-serum.

BALLOONS TO STUDY HIGHER ATMOSPHERE DURING STORM

STRATOSPHERE-SEEKING balloons, going up to study atmospheric conditions 15 miles above the earth, will court stormy weather instead of avoiding it, when the second mass flight launched by the Massachusetts Institute of Technology takes off from Lambert Field airport at St. Louis, Mo., in the near future. They will wait for word of an approaching storm area, and then hop off.

It is expected that every balloon in the flight will be wrecked; indeed it is even arranged that they shall burst. But there will be no human casualties. The 35 big gas bubbles in rubber will all be pilotless. They will carry only feather-weight meteorographs, which are instruments that automatically record temperature, humidity and air pressure.

When released, the balloons will not be fully inflated, to allow for expansion as they mount toward the 15-mile altitude they are designed to attain. Finally, when the thin rubber can stretch no farther, the balloons will burst. The meteorographs will then float downward on parachutes, and the slight shock of their landing will be broken by the light cages of split bamboo in which they are enclosed.

Attached to each meteorograph is a label announcing a reward for its return to Professor C.-G. A. Rossby, of the Massachusetts Institute of Technology. Professor Rossby states that of the 38 meteorographs sent aloft on the first mass flight last February, all but two were safely returned, their valuable records intact.

The mid-continental launching point at St. Louis was chosen, rather than the campus of the institute itself, because of the general drift of the atmosphere from northwest to southeast, it is explained. Balloons launched at St. Louis last winter fell in southern Illinois; if launched at Boston the chances are they would have fallen at sea and been lost.

DAILY VARIATION IN COSMIC RAYS

By Science Service

RESULTS of three years of research at the University of Innsbruck show that there is a daily, regular variation in the intensity of the cosmic rays striking the earth. Over 18,000 measurements have been made. The effect has been suspected but never proved conclusively. Dr. Victor F. Hess, working with Drs. R. Steinmaurer and H. Graziadei, of the university, will shortly announce to the Vienna Academy of Science that measurements in their cosmic ray meters indicate a daily fluctuation in intensity. The maximum occurs at midday, the minimum between 9 P. M. to 3 A. M. at night. The cosmic ray station at Innsbruck has been taking cosmic ray measurements continuously since September 1, 1931. Some of the apparatus has never stopped during that time. The station is high in the Tyrol Mountains at an altitude of 2,300 meters above sea-level, or well over 7,600 feet. The research program is part of the present world-wide plan to study cosmic rays.

That cosmic rays varied in intensity throughout a single day has been suspected by scientists but never before proved. Reporting in a preliminary announcement to the German scientific journal *Forschungen und Fortschritte*, Dr. Hess states: "It is not to be wondered at that for a shorter series of cosmic ray measurements at lower altitudes the daily change was not noted."

While avoiding a dogmatic assertion that the sun affects cosmic ray intensity, Dr. Hess suggests it would not be surprising if the changes in the magnetic and electric fields surrounding the earth—changing as they do from day time to night—might alter the part of cosmic rays which is now known to consist of electrical particles.

HEAT-ABSORBING GLASS

SCIENCE has now produced glass which removes most of the heat rays in sunlight, yet passes almost all the visible part of the solar spectrum. Wide usefulness for the development is seen in skylights and windows in industrial plants of the south during the hottest months of the summer. In addition the new heat-absorbing glass is hailed in the field of air conditioning for in this case it keeps the "cold" in, by keeping warmth out.

How the new type glass absorbs heat rays, and how much, was described before the Optical Society of America at its nineteenth annual meeting at the National Bureau of Standards, Washington, D. C. Dr. Roger S. Estey, physicist of the Electrical Testing Laboratories, New York City, described the characteristics of the new glass.

Solar energy as it seeps through the atmosphere of the earth, Dr. Estey explained, has only about one third of its rays in the visible region of the spectrum. A total of 66 per cent. of sunlight consists of an invisible ultra-violet light on one side and the unseen infra-red, or heat, rays on the other. The heat-absorbing glass cuts down, markedly, the heat ray portion of the spectrum.

Small amounts of iron in the glass act as the "heat catchers." Some types of glass will stop and absorb 52 per cent. of the heat rays. Eight per cent. of the sunlight is reflected off the front surface of such glass. The remainder consists of the visible rays. While heat absorbed in the glass must be re-radiated, much of it can be carried away by the proper design of ventilation around the window or skylight. What remains after this process is radiated, half to the outside, and half inside. The part coming into the room is spread out in all directions. A person sitting in a beam of sunlight in the room feels little, if any, heating from the beam because his body subtends such a small angle compared with the solid angle of the room.

The development of the commercial use of heat-absorbing glass, according to Dr. Estey, came about because of research on heat-absorbing glass filters in motion picture projection machines, and because of the need for improving the shatter-proof windows in automobiles.

Shatter-proof windows are laminated glass "sandwiches" made of a layer of celluloid cemented between two layers of glass. Until recently sunlight turned the celluloid yellowish in color. In a study of how to prevent this phenomenon it was found the rays of sunlight had to be absorbed more strongly. When the problem was solved it was found a heat-absorbing glass had been developed.

REPTILES OF THE SOUTHWEST TWO HUNDRED MILLION YEARS AGO

REPTILES as big as St. Bernard dogs were plentiful along stream banks and swamp lands of the Southwest some 200,000,000 years ago. These animals probably bore some resemblance to the large lizards of to-day, but were more sluggish in movement. They were stockily built, with short legs and broad, flat feet. There were also smaller reptiles, some no bigger than a mouse.

This picture of the distant past is drawn by Dr. C. L. Camp, director of the museum of paleontology at the University of California, who has returned from New Mexico, where he and his assistants discovered large fossil deposits in a region about 75 miles from Santa Fé, in the Chama River country.

In a preliminary survey of these fossil beds some time ago, Dr. Camp found pockets in them which revealed new material. These pockets, he says, probably represent pools of water in which bones were deposited in clay. On the trip this summer, H. T. Anderson, member of Dr. Camp's party, found a pocket of this nature, which was about seventy feet long and thirty feet wide, containing fossils of animals that had lived there during the Permian geologic period, a long era of world-wide "hard times" that followed on the heels of the Coal Age, which represented an era of geological "prosperity."

It was here that Dr. Camp uncovered a large quantity of bones of primitive reptiles. One of the skulls found was of a reptile about the size of a small dog. Its teeth were cylindrical in shape, about 1½ inches long, and located at the front of the snout.

Some of the other smaller animals had button-like teeth on the roof of their mouths; others had short, chisel-like teeth; still another form had 24 long needle-like teeth in a jaw only two inches in length.

The most valuable of these specimens were "blocked up" in plaster of Paris. Some of these blocks weighed about 400 pounds. They had to be carried in a sling fashioned between two poles for a distance of half a mile to the waiting trucks. About 3,000 pounds of material was packed out in this manner. These specimens are now in the keeping of the University of California's museum of paleontology.

ITEMS

REINMUTH'S comet of 1928, first seen by Professor K. Reinmuth, of Heidelberg Observatory, on February 22, 1928, has been rediscovered by Dr. H. M. Jeffers, of Lick Observatory. This is the report of Dr. Harlow Shapley, director of Harvard College Observatory, which is the coordinating center for astronomical data. Between one and two o'clock Pacific Standard Time in the morning of November 5, Dr. Jeffers first caught sight of the diffuse, faintly glowing object north of the constellation of Orion, which at this hour is slightly southwest of the zenith overhead. Powerful instruments are needed to detect the faint object of the sixteenth magnitude of brightness.

ASTRONOMERS are now observing the little planet Hidalgo, which has come into view again through large telescopes after being invisible since 1925, the year following its discovery. Hidalgo is of interest because it looks like an asteroid, but moves like a comet. It is inclined to the ecliptic, the path of the sun through the sky, by some 37 degrees, more than that of any other asteroid, an amount which is not unusual for a comet. Hidalgo was rediscovered in August by W. R. Boyd, of the Harvard Observatory, and was recently picked up at the Simeis Observatory in Russia by Professor G. Neujmin. It is moving through the constellation of Pisces high in the southwestern sky in the late evenings. At it is of the twelfth magnitude, it can be seen only through powerful telescopes.

FOSSILS of fern-like plants of very simple structure with a great deal of branching stem but with nothing that can be surely identified as leaves, have been found in a deposit of Lower Ordovician limestone at Beartooth Butte, Wyo., by Dr. Erling Dorf, of Princeton University. Together with other similar fossils found in a very few scattered places over the earth, they belong to the oldest known groups of land plants, known to botanists as the order Psilophytales. The limestone mass in which they occurred in the Beartooth Butte formation contained evidences of having been formed where a broad-mouthed river met the sea. The fossils, which when they were living plants probably grew as a fringe of vegetation along the marshy shores, were intermingled with armor-plates from the skin of the primitive fishes of the remote time. Dr. Dorf collected the fossils with the assistance of a field party supported by the William Berryman Scott Research Fund of Princeton University. His technical description of the five species discovered has been published in *The Botanical Gazette*.

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The recently modified form of this Photometer gives an instrument exceptionally compact and convenient in use by itself or in conjunction with accessories as a Spectrophotometer.

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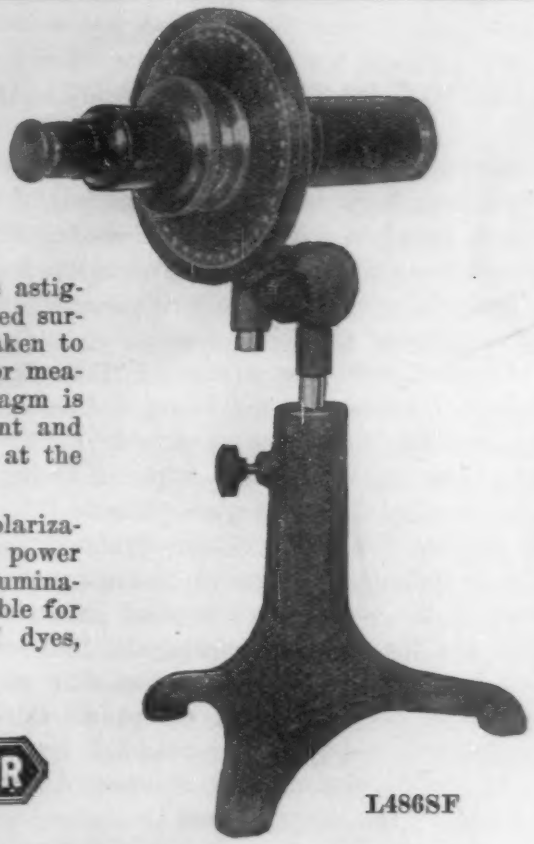

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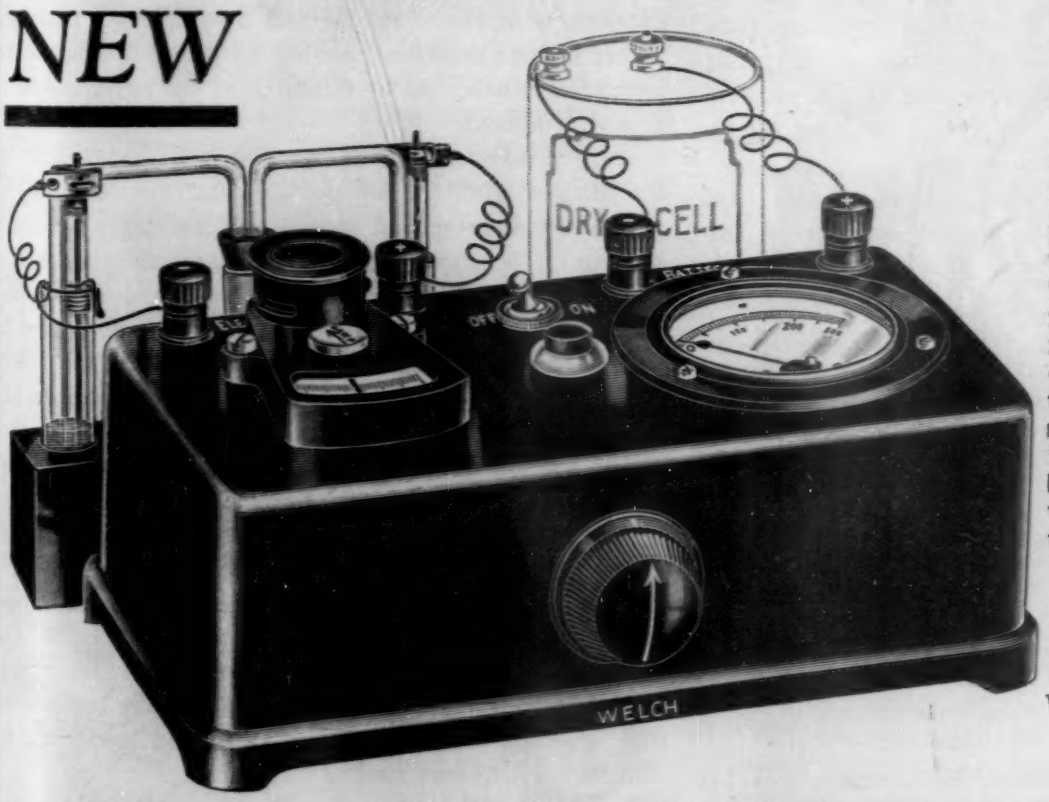

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SCIENCE NEWS

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COSMIC RAYS AND THE ORIGIN OF THE ELEMENTS

PENETRATING cosmic rays striking the earth for eons of time may have caused the formation of the varied elements, found in the top few miles of crust, from the supposed iron and nickel core. This is the suggestion of Professor Gilbert N. Lewis, professor of chemistry at the University of California.

Professor Lewis' theory, entitled "The Genesis of the Elements," appears in the *Physical Review*. Professor Lewis is world-famous among chemists for his researches, among them the development, with Dr. Irving Langmuir, of the so-called Lewis-Langmuir atomic theory.

In summarizing his hypothesis, Professor Lewis writes: "The hypothesis is suggested that a great part of the matter in the universe is composed chiefly of iron and nickel, like the metallic meteors, and that such material which is thermodynamically stable with respect to all spontaneous transmutations, except at extremely high temperatures, is superficially attacked by cosmic radiation to produce the material represented by the earth's crust and by the stony meteors."

The metallic meteors consist of more than 99 per cent. iron and nickel, while the stony meteors are much less dense and are more like the rock of the earth's crust. "It occurred to me," continues Professor Lewis, "that if the crust of the earth, and especially if the stony meteors, are representative of the material produced by the disintegration of the primal substance of the metallic meteors, then there should be discernible some immediate genetic relationship between the abundance of the main atomic species of the stony meteors and of the metallic meteors." Professor Lewis has found striking agreement in his search for such relationships.

The analysis of metallic, iron meteors reveals that over 99 per cent. of the mass present consists of two isotopes or iron and two isotopes of nickel. If cosmic rays had energies sufficient to split these iron and nickel atoms in half, two atoms of silicon would be formed for every atom of the twice-as-heavy iron and nickel atoms. Next to oxygen, silicon is the most prevalent element found in the earth's crust, and comprises more than a fourth of the mass of the crust. In turn, the various isotopes of silicon might be disintegrated by cosmic rays to form magnesium and helium. Magnesium occurs widely, in combination, throughout the earth's crust in great abundance. Counting three isotopes each of silicon and magnesium and aluminum and sodium which, conceivably, could be formed in the two steps outlined, eight of the eleven most prevalent constituents of stony meteors are accounted for.

Concluding his report, Professor Lewis states "It has been my purpose, not to erect any complete cosmological theory which would state the origin of the disintegrating rays, or where or when the material represented by the metallic meteors has been converted into the material represented by the stony meteors, but rather to present the very strong evidence for a genetic relationship between these two kinds of material, and to consider the various processes by which the genesis may have occurred."

CAUSE OF THE STRATOSPHERE BALLOON FAILURE

BECAUSE the giant stratosphere balloon, *Explorer*, on its ill-fated flight in July had the lower part of its rubber-sticky fabric tucked up inside the balloon, great tears occurred which brought a precipitate ending to the flight.

This is the finding of a scientific inquiry as to the cause of the accident made by a board of review consisting of Dr. L. J. Briggs, *chairman*, National Bureau of Standards; Dr. John O. La Gorce, National Geographic Society; Brigadier-General O. Westover, U. S. Army Air Service; Dr. W. F. G. Swann, Bartol Research Foundation, and Dr. L. B. Tuckerman, National Bureau of Standards, as reported by Dr. Briggs and Dr. Tuckerman.

To avoid difficulty in inflation and launching, great folds of fabric that would not be expanded by gas until the balloon had risen about 60,000 feet in its 75,000-foot projected climb were accordian folded inside with the idea that as the bag increased in size in the rarefied atmosphere it would come loose neatly. But the designers did not realize that the new way of folding would not allow the adherent rubber-coated fabric to peel loose, as happens with the usual method of folding. The inside layers became taut first, setting up shearing stresses that broke the fabric. So at 60,000 feet, the tears began and forced a descent.

An explosion of the lifting hydrogen gas mixed with air oxygen admitted by the torn balloon was the final act in the disaster and caused the disintegration of the balloon. The three Army officers scrambling for parachute jumps from the gondola below heard no explosion. Set off by a spark of static electricity, the explosion took from 5 to 6 seconds, Dr. Tuckerman estimated, and its low rumble was masked by the sound of the motor of an airplane flying nearby. This explosion disintegrated the upper portion of the balloon and allowed the remains to fall freely 3,000 feet to the earth.

Drs. Briggs and Tuckerman are sure that the cause of the ripping can be eliminated if future stratosphere balloons are built for another trial under the auspices of the National Geographic Society and the U. S. Army. The lower portion of the balloon, for instance, might be folded outside instead of inside, as in older balloon practise, and the difficulties in inflating and launching overcome by a different method of handling.

FERTILIZING AND SOIL EROSION

FERTILIZING and liming soil pays not only in increased crop yields but indirectly in decreased losses of top soil due to erosion. This point was stressed in an address at

the Iowa State College by R. E. Uhland, of the U. S. Soil Erosion Service, before a group of investigators assisting in the commemoration of the first modern laboratory in the natural sciences, established at the college sixty years ago by the late Professor Charles Edwin Bessey.

Mr. Uhland told of experiments conducted under his direction at a soil erosion station near Bethany, Mo. Here strips of sloping soil are planted in various crops, with and without fertilizer, and the losses in run-off water and eroded top soil are kept accurately checked. Unfertilized land under corn lost soil 300 times as fast as did the comparison strip under the much closer-growing alfalfa, and had nine times more loss in run-off water.

The use of fertilizer greatly increased the contrast between "close" crops like alfalfa and grass and "open," vegetation-free soil. From areas cropped under a three-year rotation of corn, wheat, clover and timothy the loss of soil where neither fertilizer nor lime was used was at the rate of little less than 12 tons per acre, as compared with only 3.74 tons per acre, where lime and fertilizer was applied and the same rotation used.

These results show that "lime and fertilizer applied once in the rotation may greatly reduce erosion," according to Mr. Uhland. "This fact was very forcefully demonstrated in 1932 when land in corn following clover that had formerly been limed and fertilized at wheat seeding time lost soil at the rate of 9.8 tons per acre, as compared with a loss of 19.6 tons per acre from adjoining land, which was not limed or fertilized, but which had the same cropping system. This same year land in corn, following corn, lost soil at the rate of 48.6 tons per acre, which was more than five times the loss from fertilized land on which a good cropping system was followed. This indicates that there is a marked residual effect of both the preceding crop and fertilizer treatment. It shows also that there is a marked difference in the soil loss from land in the same crop especially where the crop is poor."

AREA OF LOW MORTALITY IN THE CENTRAL AND NORTHWEST STATES

THE healthiest regions of the country, judging by the annual death rates for a three-year period, are three states in the Northwest and an area in the very middle of the United States which extends from Texas to the Canadian border.

In North and South Dakota less than eight out of every thousand persons die each year, an exceptionally low death rate. The rate for the country as a whole is ten per thousand. Next lowest death rates, between eight and nine per thousand, are found in Nebraska, Kansas, Oklahoma, Minnesota, Iowa and Wisconsin, and in the three states of the northwest corner, Washington, Oregon and Idaho. These figures are for white persons including Mexicans, standardized to allow for variations in age distribution, and were analyzed by statisticians of the Metropolitan Life Insurance Company. They relate to the three-year period, 1929–31.

The death rates have a curious geographic distribution, the statisticians point out. Just as the lowest rates are found in adjoining areas, the highest rates are also found in adjoining states, Arizona and New Mexico, with the next highest in adjacent Colorado and Nevada. The first two states had rates of over 12 per thousand, the latter two between 11 and 12.

The entire Eastern seaboard from Florida to New England and including Massachusetts, Maine, West Virginia and Tennessee, form another contiguous area having the same range of mortality, all falling between 10 and 11 per thousand. Illinois and Louisiana belong in this group, but no states west of the Mississippi River have death rates falling in this group.

Following the death rates further on the map, the statisticians found that states having a range of between 9 and 10 form two areas just to the east and west of the areas of lowest mortality. The eastern group is made up of Ohio, Michigan, Indiana, Kentucky, Missouri, Arkansas, Mississippi, and, jumping over the southern tip of Alabama, takes in Florida. The western group includes Montana, Wyoming, Utah and, skipping across Nevada, adds California.

The low death rates in the Dakotas are explained by the statisticians as due to the favorable climate and relatively safe, comfortable life on farms and small towns which combine to keep people well in these states and adjacent areas. The large proportion of Mexicans and the influx of many persons suffering from tuberculosis probably account in part for the high death rates in Arizona, New Mexico, Colorado and Nevada.

ITEMS

LEPROSY may be spread by healthy, unsuspected carriers of the infection, as typhoid fever and diphtheria are occasionally spread. Evidence that this may be the case has been reported to the U. S. Public Health Service by one of its officers, Dr. N. E. Wayson, director of the Leprosy Investigation Station at Honolulu. Persons may be infected with the bacillus of leprosy and remain well for a long time, if not indefinitely. A group of children of leprous parents were carefully examined over a period of years. Minor but definite evidence that the disease was attacking them was found in the condition of their small blood vessels and certain nerves long before other signs of leprosy could be detected. Nerve changes suggestive of the disease may stop or the nerves may grow more nearly normal again without the development of other signs accepted as characteristic of the disease.

BORON, familiar to most of us in its common compound borax, can cause spots that look as though they were caused by disease organisms, according to Dr. J. J. Christensen, pathologist of the University of Minnesota. Excess boron in the soil frequently brings them out. The boron spots resemble the common spot blotch disease of barley, making it difficult to diagnose the condition without careful laboratory examination. The spots may be artificially induced by adding either borax or boric acid to the soil in which the plants are growing.

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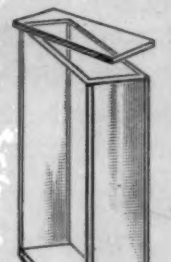

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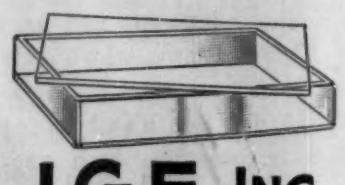

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SCIENCE NEWS

Science Service, Washington, D. C.

A NEW THEORY OF RELATIVITY

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A NEW mathematical theory of relativity, which may overthrow the world-famous theories of Professor Albert Einstein, has been presented before the United Provinces Academy of Sciences, India, by Sir Shah Sulaiman, chief justice of the High Court of Allahabad. The distinguished Indian justice is an Oxford-trained mathematician with a wide reputation in the field of relativistic mathematics. Investigators throughout the world are checking through the mathematics of Sir Shah's report because it appears to be a sane borderline between classical mechanics of Sir Isaac Newton and the newer concepts of Professor Einstein.

The mathematical equations reduce to the equations of Newton as a first approximation and likewise to those of Einstein as a second approximation. Describing such a two-way working of the new theory Sir Shah reports, "If it can be shown that the ordinary principles of dynamics, when applied to moving bodies, themselves yield modified forms of equations, which as a first approximation reduce themselves to Newton's forms, and as a second approximation to Einstein's forms, the Newtonian mechanics would be restored to the eminent position it occupied before its dethronement by relativity, and there would no longer be an absolute necessity to accept the extraordinary hypotheses on which relativity is founded."

Sir Shah points out that from his new theory theoretical values derived from equations tally more exactly with observed values. The predicted deflection of starlight as it passes close to the sun comes out to be 2.66 times that predicted by Newton's laws and closer to observations than Einstein's prediction of twice the angle derived by Newton's mechanics.

The shift of the Fraunhofer lines in the sun's spectrum is predicted more closely by Sir Shah's theory than by that of Professor Einstein. The shift comes out to half that predicted by relativity.

Moreover, both velocities of recession and approach are permissible for nebulae so that the universe is stable and not necessarily exploding or expanding.

Discussing the principles of Newton and those of Einstein, Sir Shah says:

"Newton assumed that gravitation had an instantaneous effect, however distant the object might be. This implied that its velocity was infinite. He further assumed that the same law of gravitation applied between two bodies, whether they were at rest or in relative motion. Later observations showed that his law was inaccurate for moving bodies.

"Einstein has given a slightly more accurate law, but at the complete sacrifice of the principles of Newton. Relativity denies the absoluteness of space, time and motion, but can hardly deny the absoluteness of angular motion or sudden change of motion.

"When a boy spins a top, does he give an absolute rotational motion to the top or does he set the entire universe revolving round the top in the opposite direction?" asks the Indian mathematician. Or again, when a motorist suddenly puts on his brakes, does he stop his car or does he push the whole universe on a backward path?

"Relativity makes the velocity of light absolute, and although it is a known finite velocity (300,000 kilometers a second), the properties of infinity are attributed to it; and no velocity, howsoever great, when added to it or subtracted from it, can ever make any difference. Relativity makes time and mass depend on velocity, and yet it is immaterial whether the body is approaching or receding from the observer. Max Born has pointed out, 'that by Relativity if A and B are twin brothers, and B makes a journey, then B must be younger on his return than A. This is truly a strange deduction, which can, however, be eliminated by no artificial quibbling. We must put up with this.' Relativity makes space finite, and yet makes its finite limit incapable of being reached except in infinite time, by making time itself slow down with distance, and ultimately become stationary."

THE ECLIPSE OF THE BINARY STAR, ZETA AURIGAE

ASTRONOMERS at Harvard College Observatory are bemoaning 3,000 wasted opportunities they have had in the last fifty years to learn the composition of the outer atmosphere in distant stars.

The usefulness of double or binary stars, which eclipse one another at intervals just as the moon eclipses the sun, for revealing the make-up of stellar atmosphere has only recently been realized. Zeta Aurigae, a star of the fourth magnitude visible to the naked eye, is especially favorable for such eclipse observations. In recent months it has been the most observed star in the sky, according to Dr. Harlow Shapley, director of the observatory.

The irony of the matter and the wasted opportunity is that an examination of the vast number of star photographs in the Harvard collection shows that 3,000 times in the last fifty years Zeta Aurigae has been photographed. Among the 3,000 Zeta Aurigae "portraits" there must have occurred some that included the special eclipsing conditions.

Zeta Aurigae has, as the two parts of its binary structure, a large red star and a small blue one. Each has the same mass; hence the blue component must be many times as dense as the red one. A difference in density of 25,000 times is not improbable. About once every 1,000 days the red star blocks off the light from the blue one in Zeta Aurigae and creates an eclipse. At such times—just as in the case of the sun and the moon during a total solar eclipse—the intense light from the body of the blue star is cut off and the radiation in its outer chromosphere can be observed. Instead of the period of totality lasting for some few minutes, as in the case of the sun, it lasts an entire month for the blue star in Zeta Aurigae.

Zeta Aurigae has been the favorite for observation recently because last October was the month in which the totality of eclipse occurred. Unfortunately for astronomy, the star was above the horizon only during the daylight hours in Europe, so that continental observers could not take adequate measurements. In the United States cloudy weather prevailed much of the time so that the results for the first "stellar eclipse" expedition was scanty.

The next favorable eclipse of Zeta Aurigae will occur eight years hence. Two other eclipses will occur prior to that of 1942 but they will not be easily observable in present-astronomical observatories. One thing is sure, however. Astronomers will no longer neglect their opportunities now that they realize what knowledge can be gained by close observation of the eclipsing binary, Zeta Aurigae.

ONCHOCERCIASIS IN THE BELGIAN CONGO

DEFINITE verification of the fact that the tropical fly-bite disease of onchocerciasis, causing blindness, is widely prevalent in the Belgian Congo, has been made by Dr. Richard P. Strong, of the Harvard Medical School, who has returned from a seven months' study in the densely populated region of the Belgian Congo. The results of his investigation are regarded as an important contribution to the knowledge of tropical medicine.

The eye-afflicting form of this disease was previously known definitely to exist only in Guatemala and Mexico, while another form of the disease, not associated with blindness, had been known to be rampant in Africa.

The expedition was under the auspices of the Harvard University department of tropical medicine and continued investigations previously carried on by Dr. Strong in Guatemala, Liberia and the Belgian Congo on the control of the disease.

In the party were Dr. Strong, one of the world's noted authorities on tropical diseases; Dr. J. Hissette, Belgian oculist who had previously carried on research of this nature in the Congo; Dr. Joseph C. Bequaert, entomologist; Dr. Jack H. Sandground, helminthologist; Henry E. Mallinckrodt, laboratory assistant and photographer; R. Stuyvesant Pierrepont, Jr., zoological assistant, and Byron L. Bennett, technician.

Most of the clinical and pathological studies of the expedition were made in the most thickly populated section of the Belgian Congo where there are no white men, no doctors and no hospitals. Tests were conducted on the hundreds of natives who came daily to the expedition's station for treatment.

About a third of the wild-flies, which are especially prevalent in the rainy season, were found to be infected with the disease, and are regarded as chief carriers of the malady.

Investigations were also carried out to determine whether any of the wild game might serve as a reservoir or intermediate host for the parasite causing this disease, as is the case in sleeping sickness.

Antelopes, wart hogs, buffaloes, hippopotamuses and eland were inspected in order to determine the occurrence of the infection in the animals. Parasites of the genus Onchocerca were found in buffalo and in different varieties of antelope, roan, sable and eland, while in Northern Rhodesia, domestic cattle were found to be infected to a considerable extent.

Pending completion of laboratory tests, tentative conclusions seem to indicate that eland and domestic cattle may act as intermediary hosts, while buffalo and some antelope do not. It seems probable, according to Dr. Strong, that the parasitic infection began in wild game and was transmitted by flies to the domestic cattle. Then the flies transmitted it to man, until it became established there, and now carry it from man to man.

In 1931 and 1932, Dr. Strong conducted expeditions to Guatemala for studying the disease and made recommendations for its control among the native coffee plantation workers there.

The public health situation in the Congo, Dr. Strong states, is in many respects entirely different from Guatemala, and he doubts that it would be at all possible to eradicate the disease in Africa by employing the same methods which were so successful in the other country.

A laboratory study of the pathological material and parasites found in the Congo is now being made at Harvard by Drs. Strong and Sandground and a study of the flies by Dr. Bequaert.

PSYCHOLOGICAL APTITUDE TESTS

PSYCHOLOGICAL tests now in use to measure a man's fitness for a job are unsuitable, and new ones must be devised, according to Professor H. M. Johnson, of American University, Washington, D. C., speaking at Yale University.

The prevailing tests are based on the assumption that the relative amounts of skill or aptitude possessed by different persons can be measured and the persons rated accordingly. Professor Johnson holds that a skill or aptitude can not be treated as an abstract quality existing in a vacuum; an aptitude can be measured only concretely, only in so far as it helps to get a given job successfully done.

Professor Johnson's proposed new testing method would list the various things a hopeful candidate for each particular job would have to be able to do in one way or another. It would then analyze each of these separate demands indicating the interchangeable skills that will satisfy it. To each of these factors a specific test could then be applied. Failure in any essential factor would disqualify the candidate, rather than give him a score of two thirds or three fourths good enough, which is possible under the present methods.

A place where currently used testing methods fall down is in their assumption that a given aptitude has no substitute—that some other skill can not be transferred, to make good its lack. Thus, a present-day test for newspaper correspondents might hold it necessary that they shall be able to read and write, and hold a blind man with crippled hands as quite disqualified.

Yet that blind man, equipped with a knowledge of the Morse code, might be able to listen to Congressional debates and send vivid accounts of them directly to his telegraph editor by tapping out his story on a telegraph key. Faced with a given job, but without the conven-

tional aptitudes for handling it, he could still qualify 100 per cent. by transferring other aptitudes into the field.

LONG-RANGE WEATHER FORECASTING

POSSIBLE use of ocean temperatures in conjunction with other factors, in forecasting air temperatures and precipitation along the Middle and Northern Atlantic seaboard, has been suggested by Dr. Charles F. Brooks, director of the Blue Hill Meteorological Observatory of Harvard University, and Ernest M. Harwood, of the Blue Hill research staff.

"It seems possible," says Dr. Brooks, "that the coastal waters may give indications of the air-temperatures of the following month along the Middle and North Atlantic seaboard, low sea-temperatures being followed by high air-temperatures, and *vice versa*. Furthermore, it seems likely that the precipitation stands in inverse relationship to the general sea-temperature of the preceding month."

The data studied covered a five-year period during which sea-temperatures were recorded on sea-water thermographs installed on commercial steamships in the Western Atlantic, chiefly those sailing between New York and Bermuda. The land temperature and precipitation recordings were made at Boston and Baltimore, Md.

"The sea should have both a direct and an indirect influence on the coastal weather. The direct one should simply make the coast warmer and moister when winds blow onshore off a sea warmer than usual, and *vice versa*." The indirect effect works through the changes in general atmospheric pressure-distribution favored by departures of sea-temperature. When the sea is above normal in temperature it will not only heat the air but also give it more vapor than usual. Such heated and humified air is lighter than the average and so the atmospheric pressure is lower. The lower pressure over the sea favors northerly land-winds, both cool and dry, on the coasts to the northwest. So a warm sea should favor subnormal temperature and precipitation, Dr. Brooks believes.

Conversely, with the sea-temperature below normal the air would be denser, the pressure higher, and the wind consequently onshore from the south, bringing warmer and moister weather to the coasts. On the Atlantic seaboard, where the winds are prevailingly offshore, the direct influence must obviously be minor, therefore, the indirect should dominate. The sequences of departures of weather and sea-temperature do not show any striking opposition, so we can not say that the problem of seasonal weather-forecasting from ocean-temperatures is solved. On closer examination, however, the expected inverse relationship is found to predominate rather consistently.

GROWTH PROCESSES AND METABOLISM OF BACTERIA

DR. HAROLD MESTRES, research associate in the Department of Public Health at Yale University, explained at the recent Washington meeting of the American Optical Society the working of a new densitometer for studying the size of bacteria by the amount of light a mixture of them in a solution will transmit.

With the instrument he has been able to show not only that the growth of bacteria is quite different from older conceptions obtained by counting the growth rate at intervals, but has been able to check the way in which bacteriophage control growth of organisms. In addition the instrument will reveal the rapidity with which germicidal solutions stop the growth of organisms.

Dr. Mestres, in an interview, explained that the size and number of bacteria in a suspension in solution determines the amount of light which will pass through the containing vessel. The densitometer is a device which accurately measures the transmitted light with a photoelectric cell.

Taking a solution containing small organisms, growth can be traced, for as they grow larger and increase in number less light comes through the solution. Extinction of the light may even occur. By measuring the transmitted light at intervals Dr. Mestres was able to show, what previous workers have suspected, that during the first hour or two of growth the bacteria grow rapidly in size and do not greatly increase in number. Then, at a clearly defined time multiplication sets in and the organism population increases. Cell metabolism is therefore highest at the beginning of cell growth and not, as is generally said, after a certain period of lag.

The action of bacteriophage on bacteria shows the organisms growing steadily up to the time when the phage was introduced into the solution. Then quickly the solution begins to clear up and allow more light to pass through. This indicates that the phage is "eating up" or destroying the bacteria.

A comparable action of germicidal solutions is also noted. Up to the time the germicide was introduced growth goes on in normal fashion. Shortly after the germicide was placed on the bacteria suspension a sharp break occurred in the light transmission curves and reached a steady amount. This indicates, Dr. Mestres explained, that while the germicide kills the bacteria there is a residue of organism debris left in the solution.

First work on the development of the densitometer and its optical technique of studying bacterial growth was undertaken while he was at Stanford University. The work is now being continued at Yale where Professor C.-E. A. Winslow is chairman of the department.

ITEMS

POTATO late blight, one of the most serious of crop diseases, causing millions of dollars' worth of loss in wet years, bids fair to be eradicated if experiments now being conducted by Dr. Donald Reddick, plant pathologist of Cornell University, are finally successful. Returning from a survey trip in the highlands of central Mexico, Dr. Reddick brought back several close relatives of the potato that are immune to the disease. These plants, grown in the university's greenhouses and gardens, were used as parents for crosses with the common potato. About 200 blight-immune hybrids are being carried along in Dr. Reddick's experiments. From this list a dozen were selected that had the appearance of domestic varieties and bore from six to nine tubers of commercial size, white and smooth.

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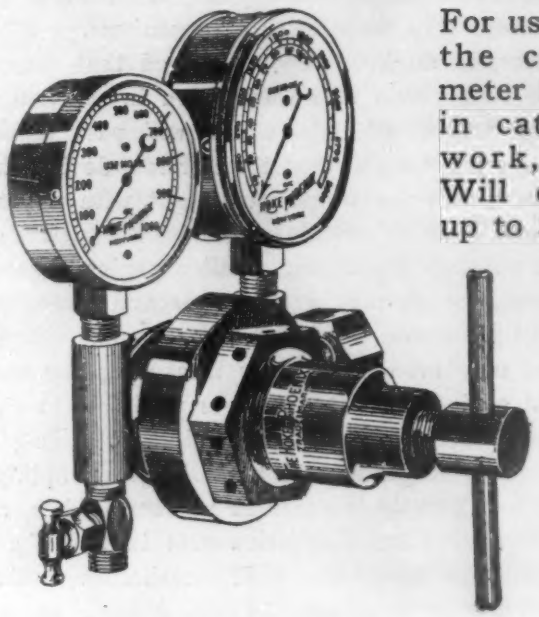

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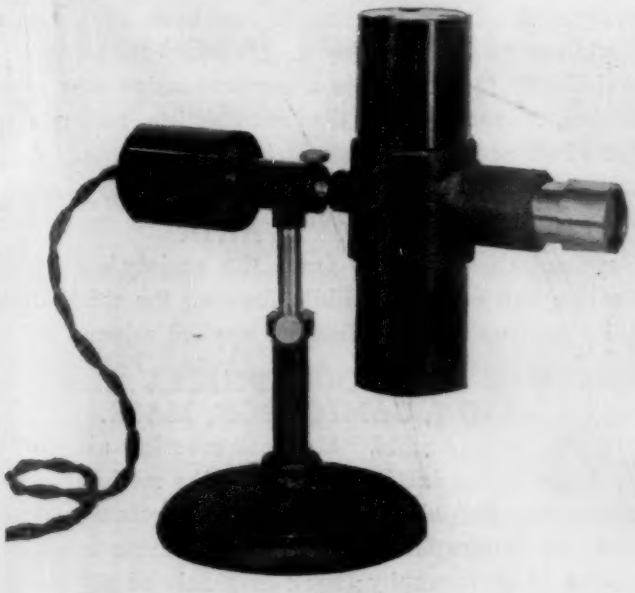

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THE H. J. HEINZ COMPANY, PITTSBURGH

Booth No. 44

Exhibit will feature the part played by science in the business of this company. The scientific organization of the company and the place of research in the development of new products, improvement in processes and the control and improvement in the quality of products will be shown graphically. Products of the company in the development of which research has been of paramount importance will be displayed. A brochure of "Nutritional Charts," covering in a comprehensive way data on vitamins, minerals and the composition and nutritive value of all common foods will be displayed.

THE HISTORICAL SOCIETY OF WESTERN PENNSYLVANIA

Supplementing objects from the society's permanent collection will be loan exhibits showing the work of western Pennsylvania in the field of applied science.

INSTITUTE OF GEOGRAPHICAL EXPLORATION, CAMBRIDGE, MASS.

By Mr. Weld Arnold. Exhibits covering airplane surveys made by the institute, showing the methods used for making topographical maps; panels representing the results of geographical expeditions; charts executed in the field of cartography; some originals of physiographical features by William Morris Davis; and a few three-dimensional models of topographical features.

INSTRUMENTS PUBLISHING COMPANY, NEW YORK CITY

Booth No. 21

An exhibit of the periodical, *Instruments*, as well as the following books: Behar's "Fundamentals of Instrumentation," "Temperature and Humidity Measurement and Control," "Process and Operation Time and Speed Control," "Pressure and Vacuum Measurement and Control" and De Juhasz' "The Engine Indicator."

THE KELLOGG CEREAL COMPANY, BATTLE CREEK, MICH.

Booth No. 13

A display consisting of the Kellogg ready-to-eat cereals and Kellogg's Kaffee Hag coffee. The exhibit will emphasize results of research which has been carried on with these products during the last three or four years.

Important New McGraw-Hill Books

Introduction to Atomic Spectra

By HARVEY E. WHITE, University of California. *International Series in Physics.* 457 pages, $5.00

"I have looked it over with the greatest interest and think that Professor White has done us all a very great service in producing this extraordinarily good book. It will certainly fill a need that is not supplied by any other book that I know of. The photographs and diagrams are very well chosen and executed. Professor White's work shows a rare combination of ability in theory and in experiment, which is reflected in this work."

—Professor Frederick A. Saunders, Harvard University.

Principles of Mathematical Physics

By WILLIAM V. HOUSTON, California Institute of Technology. *International Series in Physics.* 265 pages, $3.50

Aims to fill the gap between the elementary courses in physics and the more advanced treatises on special subjects. It introduces the student to the more powerful methods of treating physical problems by giving him an opportunity to apply them to simple cases. One of the outstanding features of the book is the extensive problems, which form an integral part of the text and which are designed to develop the student's resourcefulness.

Experimental Physical Chemistry. *New second edition*

By FARRINGTON DANIELS, J. HOWARD MATHEWS and JOHN WARREN WILLIAMS, University of Wisconsin. *International Chemical Series.* 499 pages, $3.50

As before, this comprehensive laboratory guide seeks to illustrate the principles of physical chemistry, train the student in careful experimentation, develop familiarity with apparatus, and encourage ability in research. The book has been thoroughly revised, particularly the chapters dealing with electrochemistry and related fields. Several new experiments have been added and the references have been brought up to date.

Introduction to Mechanics and Heat

By NATHANIEL H. FRANK, Massachusetts Institute of Technology. 339 pages, $3.00

A systematic elementary treatment of the fundamentals of mechanics and heat, characterized by a close-knit structure and a logical, unified presentation. Emphasis is placed on the quantitative aspects of all topics, on unity of thought, and on the method of applying fundamental principles to actual problems, of which numerous examples are given. The use of special formulas for special problems is avoided.

The Physical Basis of Things

By JOHN A. ELDRIDGE, University of Iowa. *International Series in Physics.* 407 pages, $3.75

This book—new in spirit, different in approach and style—explains, with emphasis on concrete illustration and with only the simplest mathematics, the meaning of those ideas which, evolving from the older kinetic theory, have culminated in the new atomic theory of today. The author tells what modern physics is, how it has developed, what it has done, and suggests some of its possibilities.

Send for copies on approval

McGRAW - HILL BOOK COMPANY, INC.

330 West 42nd Street, New York

Aldwych House, London, W.C.2.

LIQUEFACTION OF OXYGEN AND OTHER EXPERIMENTS

By Professor Charles T. Knipp, University of Illinois, assisted by Professor J. B. Nathanson, Carnegie Institute of Technology. List of demonstrations: (1) Liquefaction of oxygen by three methods; (2) Active nitrogen afterglow in a bulb prepared in 1930 and in a freshly prepared bulb; (3) Flash in the afterglow of an electrodeless discharge about three seconds after excitation; (4) Positive rays in helium, in 25-liter dumb-bell shaped container—beams 40 cm. in length,—hollow cylindrical cathode; (5) Positive rays in helium,—triangular hollow cathode; (6) Molecular or atomic bombardment, a striking demonstration of Boltzman's law; (7) Cathode rays leave the surface normally.

LEEDS AND NORTHRUP COMPANY, PHILADELPHIA

Booth No. 27

Exhibit of new a.c. bridges, resistors, capacitors, oscillator and amplifier for high precision measurements at high frequencies, and a demonstration of the I & N glass electrode for pH measurements. The company will also be prepared to discuss the use of the other types of electrical measuring and control equipments in which they specialize.

E. LEITZ, INC., NEW YORK CITY

Booth No. 70

The new Leitz universal photo-micrographic equipment "Panphot," which permits observations and photography by transmitted, ordinary as well as polarized light, by reflected as well as reflected polarized light, darkfield illumination, etc., will be on display. Research microscopes, Dr. Chambers' Micro-Manipulator and a complete display of Leica equipment will be available, in charge of trained technical representatives.

THE MACMILLAN COMPANY, NEW YORK CITY

Booth No. 71

This exhibit will be divided into six sections; engineering, chemistry-geology, physics, biology, mathematics and psychology. In each section both standard and recent texts, reference and collateral works will be on display and a special feature will be found in a display of scientific works for the lay reader. The Macmillan representatives will be prepared to answer any questions in connection with scientific publications.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Demonstration model of Van de Graaff 15,000,000 volt electrostatic generator, possibly accompanied by explanatory film. New mechanical aids to the solution of mathematical problems, such as recently tested new device for the solution of simultaneous equations, and unit of new cinema integraph for the solution of problems in integral calculus. Twenty-minute film of ultra slow motion movies taken by means of the Edgerton stroboscope, which among other things will show certain new ideas regarding traveling waves on transmission lines. Exhibit relative to new highly sensitive thermocouple; a packing model representative of atomic arrangement in crystalline structures.

McGRAW-HILL BOOK COMPANY, NEW YORK CITY

Booth No. 4

Advance proofs of important forthcoming books in the fields of science will be on display, also an exhibit of recent McGraw-Hill books in the fields of biology, chemistry, forestry, geography, geology, metallurgy, physics and psychology.

MELLON INSTITUTE OF INDUSTRIAL RESEARCH

An information booth, at which particulars can readily be obtained regarding the industries and institutions of the Pittsburgh district. Another service of this bureau will be to arrange for inspectional trips, especially through the buildings of Mellon Institute.

METROPOLITAN LIFE INSURANCE COMPANY, NEW YORK CITY

Booth No. 12

Progress in Public Health since 1900: An exhibit of charts showing (1) the past and present public health problems in the United States as indicated by the death rates from the leading causes of death, 1900 and 1932; (2) the trend of the crude death rates of the leading causes of death during the past three decades; (3) the increased chances of survival to each age, during the like period. The object of the exhibit is to demonsrate the character of the scientific investigations conducted by the company in the important fields of vital statistics and of public health work.

NATIONAL BROADCASTING COMPANY, NEW YORK CITY

Booths Nos. 5 and 6

Exhibit will consist of graphic display of educational, religious and other public service programs which are on the air, and will also include new microphones and methods of remote control pickup of latest design and at the same time provide for distribution of free material in relation to the company's activities in both the experimental and educational fields. The company offers the courtesy of its facilities for the broadcasting of unusual features of the meetings.

NATIONAL GEOGRAPHIC SOCIETY

Exhibit of equipment used in U. S. Army Air Corps stratosphere flight of July 28, 1934, consisting of (1) a model of the gondola, to one-fifth scale, cut in half vertically so as to show the placement of the many instruments and pieces of equipment taken into the stratosphere; (2) one of the two electrical resistance thermometers which were carried on arms extending from the gondola, and the meter carried inside the gondola which registered temperatures of the outside air; (3) the spectrograph which was suspended 500 feet below the gondola and the parachute which brought it safely to earth; (4) two air sample chambers, of the type taken on the flight, in which to bring back samples of stratosphere air from several altitudes; (5) chart from the barograph records of the flight showing the pressure in millimeters of mercury for each minute of the flight.

CAMBRIDGE UNIVERSITY PRESS

LATEST BOOKS OF SCIENTIFIC INTEREST

THE GRAMINEAE

By Agnes Arber

497 pages, 213 illustrations. $8.50

A study of cereal, bamboo and grass; the history of the grass family is dealt with, followed by an exhaustive analysis of the structure of the Gramineae, their distribution, dispersal, and hybridity. The book contains a bibliography of over 500 titles.

A HISTORY OF EMBRYOLOGY

By Joseph Needham

300 pages. Illustrated. Probably $4.25

A history of the subject from the earliest times down to 1814 when John's Chemische Tabellen was published. Illustrated with numerous plates.

INEQUALITIES

By G. H. Hardy, J. E. Littlewood and G. Polya

326 pages. $4.75

The first six chapters contain an account of the inequalities, such as Holder's inequality, most commonly used in analysis; the treatment of these is comprehensive and in some ways exhaustive. The remaining chapters are on subjects suggested by the more systematic investigations which precede, and serve as an introduction to regions of analysis in which inequalities play a central part.

MANUAL SKILL, ITS ORGANIZATION AND DEVELOPMENT

By J. W. Cox

268 pages. Illustrated. $5.00

This new volume in the Cambridge Psychological Library considers the problem of measuring manual skill and the nature of the factors which determine its organization, together with an investigation of the conditions under which manual skill is best developed.

ELEMENTARY QUANTUM MECHANICS

By R. W. Gurney

200 pages. $2.25

This book enables the reader to think in terms of wave mechanics as easily as he could formerly in terms of atomic models. Atomic and molecular problems are treated by graphical methods, carefully explained and illustrated by more than sixty diagrams. The last two chapters give a simple development of the Dirac perturbation theory.

Prospectuses will be sent on request

THE MACMILLAN COMPANY 60 FIFTH AVENUE NEW YORK

OHIO CHEMICAL AND MANUFACTURING COMPANY, CLEVELAND

Booth No. 35

Will exhibit cylinders of all the special gases they supply and a complete assortment of regulating devices recommended for handling high pressure gases from cylinders. In addition will have on display perhaps five or six grams of Deuterium Oxide "Heavy Water" ranging in concentrations from 50 per cent. to 100 per cent. This company is the only commercial organization engaged in the production of Deuterium Oxide.

THE JOHN C. OLIVER MEMORIAL RESEARCH FOUNDATION, ST. MARGARET MEMORIAL HOSPITAL, PITTSBURGH

This institution will exhibit: (1) laboratory procedures for the estimation of sex hormones, including the Friedman test for pregnancy, estrogenic hormone (according to Kurzrok), and prepituitary hormone (Ascheim-Zondek); (2) treatment of Osteromyelitis by means of blow-fly larvae, including the breeding of sterile larvae, clinical application (motion picture), and investigations into the modes of action of blow-fly larvae (maggots); (3) an apparatus for the intravenous administration of dextrose and other fluids and a recommended method for preparing dextrose solutions for intravenous use. Tables, charts, photographs, apparatus, models, animals and insect material will be used.

PHIPPS AND BIRD, INC., RICHMOND, VA.

Booth No. 81

Laboratory supplies and chemicals: Motor-driven Kymograph for student use; self-contained inductorium; gravity air tambour; physiology laboratory equipment; electrically heated drying ovens and incubators, with important innovations in design and operation; also a Phipps & Bird solution feeder, which sanitary engineers commend for operation, cost and accuracy, and the Neale-Forbes titration assembly, which offers a novel accurate feed control for titration.

PHOTOGRAPHIC SECTION OF ACADEMY OF SCIENCE AND ART OF PITTSBURGH

Selections from the annual International Salon of Photographic Art which is exhibited in the art galleries of the Carnegie Institute.

PITTSBURGH PLATE GLASS COMPANY, PITTSBURGH

Booth No. 16

This company will display the several different types of glass which they manufacture and will illustrate their several different characteristics as to light transmission, heat transmission, strength, safety features, etc. They will also exhibit a small experimental pot showing the type of container in which glass is melted and some of the different types of special glasses, such as structural glasses, x-ray protective glasses, welding glasses and similar materials, as well as some of the types of machinery used in making polished plate glass.

DR. M. A. RAINES, HOWARD UNIVERSITY, WASHINGTON, D. C.

A set-up for testing the effect of environmental conditions on the growth of the young root.

SMITHSONIAN INSTITUTION, DIVISION OF RADIATION AND ORGANISMS

Exhibit consisting of monochromatic light filters (Christiansen) with explanatory material. The filters shown were used by Dr. C. G. Abbot in stellar investigations. These filters and others used in plant growth investigations will be discussed in a paper before the Physical Society by Dr. E. D. McAlister.

SPENCER LENS COMPANY, BUFFALO, N. Y.

Booth No. 26

Demonstration of the latest developments in microscopes, microtomes and projection apparatus. The company's representatives will show the advantage of the low fine adjustment; binocular bodies with converging tubes; the newest petrographical and chemical microscopes and accessories for scientific laboratory workers.

STANDARD ELECTRIC TIME COMPANY

Booth No. 74

Electric stop clocks, synchronous motor driven, measuring elapsed time intervals, which feature accuracy to within one cycle, rugged construction, large dials, also manual, automatic and remote control.

TRIARCH BOTANICAL PRODUCTS, RIPON, WIS.

Booth No. 20

The exhibit will include prepared microscope slides in general botany, plant pathology, pharmacognosy, cytology and wood technology; preserved plants for the ordinary botany laboratory; lantern slides showing native plants and microscopic structures together with striking photographic enlargements. New catalog (No. 3) listing many new and brilliant preparations, illustrated with more than 200 original photomicrographs and photographs, including schedules of regular techniques, will be distributed free to botanists.

UNIVERSITY OF CHICAGO

By Professor Arthur H. Compton. Exhibit consisting of the new cosmic ray counting meter and of one of the Model A instruments as used by Carpe and Koven on Mt. McKinley and later sent into the stratosphere with Settle and Fordney. The instrument is similar to the one now in use by Poulter and Fordney in the Antarctica.

UNIVERSITY OF PITTSBURGH, PHYSICS EXHIBIT

The nucleus of this exhibit, under the direction of Dr. E. Hutchisson, consists of three specially designed cabinets containing many experiments which illustrate some of the fundamental laws of physics. These experiments are set up in such a way that after being performed they return automatically to their original condition. These demonstration experiments are concerned with light, wave

(*Continued on Page 24*)

BIDDLE SPECIALTIES

Gaeue Diffusion Pump

At the Annual Science Exhibition

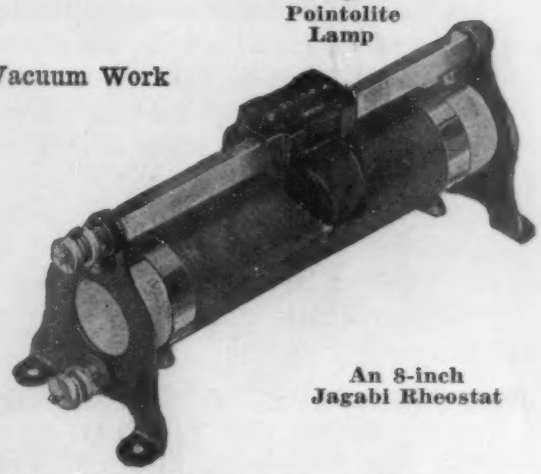
Mellon Institute of Industrial Research, Pittsburgh, December 28th, 29th and 30th, 1934.

You are cordially invited to visit our Booth No. 18, where we are planning to exhibit:

Jagabi Rheostats
Jagabi Speed-Measuring Instruments
Frahm Tachometers and Frequency Meters
Pointolite Lamps
"Megger" Insulation Testing Instruments
"Megger" Ground Testing Instruments
Gaede High Vacuum Pumps
Apiezon Oils, Greases and Waxes for High Vacuum Work
Otto Wolff Potentiometer
Kipp & Zonen Recording Microphotometer
Siemens & Halske Precision Electrical Measuring Instruments

Appropriate literature will be forwarded on request.

Pointolite Lamp



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1211-13 ARCH STREET PHILADELPHIA, PA.

HEAVY WATER

Deuterium Oxide, the new scientific research tool, is produced commercially by this company. Heavy Water of various concentrations will be displayed at Booth No. 35 (The Meeting of the American Association for the Advancement of Science).

. . . RARE AND COMMON GASES

For research and experiment, this company supplies rare and common gases of exceptional purity and uniformity. For years our plants have supplied laboratories throughout the world. May we serve you?

We offer a complete line of equipment for handling these gases from cylinders.

ALL ON DISPLAY IN BOOTH NO. 35

THE OHIO CHEMICAL & MFG. COMPANY
1177 Marquette St., N. E. Cleveland, Ohio

INVITATION

You are invited to visit our **Booth No. 75A** to examine our exhibit of biological teaching material, anatomical models, charts and other preparations for botany, geology, embryology, physiology, genetics, comparative anatomy: skeletons, skulls, bone preparations (human and zoological); Spalteholz transparent preparations; PROMAR microscopic projection and drawing apparatus; neurological charts and models.

CLAY-ADAMS COMPANY
25 East 26th Street NEW YORK

(*Continued from Page 22*)

motion and sound and the application of physics to the automobile. Many other interesting scientific experiments are presented, such as high temperature measurements, sound and the development of shatter-proof glass. A display of original developments in laboratory apparatus is included.

THE UNIVERSITY OF PITTSBURGH, DEPARTMENT OF ZOOLOGY

An exhibit of the work of the animal biologist. This series of exhibits will interpret the work of the biologist in terms of philosophic, educational and economic considerations. Among the exhibits will be a "Tree of Life" with living animals to show the gradual changes of complexity in form and function, living animals illustrating the Mendelian laws of heredity, the behavior of muscle when removed from the body, the effects of freezing living tissues, nervous activity, an experimental study in evolution, methods of teaching zoology, simulations of vital activity and the action of short radio waves on living organisms. Highly magnified motion pictures of animal life, microscopic animals and minute fragments of living heart tissue growing outside of the body will be shown. This exhibit is carried out under the direction of Professor Robert T. Hance, head of the department of zoology.

JOINT UNIVERSITY PRESS EXHIBIT
Booths Nos. 40 and 41

This will be a cooperative display of scientific and technical books by these presses: Columbia University Press, Oxford University Press, Harvard University Press, Stanford University Press, Pennsylvania University Press, University of North Carolina Press, University of Minnesota Press and University of Chicago Press. A special feature will be the continuous showing of the University of Chicago educational talking pictures in a special demonstration room.

D. VAN NOSTRAND COMPANY, INC., NEW YORK CITY
Booth No. 25

Exhibit of latest books, including the new edition of Professor Compton's book on "X-Rays," a revised edition of the "Chemical Formulary" and the second volume of additional formulas; also the first complete work on the analysis and manufacture of spirituous liquor, as well as recent important chemical publications, some imported from England.

THE VASCULAR CLINIC OF THE NEW YORK POST-GRADUATE HOSPITAL AND MEDICAL SCHOOL, NEW YORK CITY

The effect of tobacco on the temperature of the extremities as demonstrated by thermocouple readings of the skin at the base of the fingernails. Exhibit demonstrating the effect of tobacco (chiefly cigarettes) on the circulation in the peripheral part of the body. Charts showing temperature changes at the finger tips as a result of smoking tobacco. These measured temperature changes will be demonstrated at various designated times during each day. This exhibit will be in charge of Dr. A. Wilbur Duryee and his associates.

W. M. WELCH MANUFACTURING COMPANY, CHICAGO
Booth No. 7

Electron Display: Demonstration of Millikan oil drop experiment, special electroscopes and condensers, new Thorium decay apparatus, Hoag's $\frac{e}{m}$ apparatus and new x-ray absorption screen and Echelon filters. Special Vacuum Equipment: New Duo-Seal triple stage rotary oil seal pump, capacity in excess of thirty liters per minute of free air, Knipp's condensation pump, McLeod and DuBrovin gauges. General line of physical and chemical laboratory apparatus.

B. WESTERMANN COMPANY, INC., NEW YORK CITY
Booth No. 23

Exhibit of the most important publications which appeared in the German and French languages during the year 1934 in physics, mathematics, botany, zoology, chemistry, psychology, technology, geology, biology, social science, economics and general sciences.

WESTON ELECTRICAL INSTRUMENT CORPORATION, NEWARK, N. J.
Booth No. 11

An exhibit of a representative line of portable and panel types of electrical indicating instruments, many of which are newly designed. Featured will be applications of the Weston Photronic photoelectric cell and its associated apparatus. This group will include such devices as an illumination control relay, smoke alarm, Weston sensitrol relays, a line of photographic exposure meters and direct reading light-measuring instruments.

WILLIAMS AND WILKINS COMPANY, BALTIMORE
Booth No. 1

An exhibit of about twenty scientific journals published by this company, many of them being official vehicles of science societies; also samples of their book output, including works in many fields of science—medicine, biology, physics, chemistry, etc.—including books in medicine for the student and practitioner; also books by four of the leading British medical publishers, which are represented by this company.

MIESSNER INVENTIONS, INC., MILLBURN, N. J.

Mr. Benjamin F. Miessner, accompanied by the eminent concert pianist, Anton Rovinsky, will probably give an unusual demonstration with his Electronic piano on Saturday and Sunday afternoon.

REGISTRATION AND INFORMATION

The privileges to those wearing the association badge at meetings are increasing significantly. The registration is placed in the Exhibition Hall for greatest convenience. Space will be available for the use of members of the press.

THE BELL TELEPHONE LABORATORIES
Booth No. 46

Demonstrating the diffraction of electrons, complementary to the vice-presidential address of Dr. C. J. Davisson.

PRODUCTS OF SCIENTIFIC RESEARCH

A Bibliography and One of Its Books

History of Magic and Experimental Science

Volumes III and IV

By Lynn Thorndike

YOU will find a story of great scientific activity in the annals of the 14th and 15th centuries. However, clandestine, immoral, or *un*scientific much of that activity may have been, the fact remains that in those ominous times a new world was in the making. And it is to Professor Thorndike's history that you must turn in quest of the origins of modern science and the engrossing story of its evolution.

The History of Science Society, in view of the author's reputation, has made this publication the fourth in its new series.

Only One of Many

While noting the above it is well to bear in mind the fact that Columbia University Press has been publishing books since 1893. A dozen branches of scientific activity are represented by, for example, Wheeler's *Ants,* or Lynn Thorndike's earlier work *Science and Thought in the 15th Century.*

First Notice

In addition to that you will want to read two forthcoming books. First, Courtney Robert Hall's *A Scientist in the Early Republic: Samuel Latham Mitchill, 1764–1831.* Mitchill was founder of what now is the American Museum of Natural History and was one of the chief inspirators of American scientific activity. Second, we present Arthur John Hopkins' *Alchemy, Child of Greek Philosophy,* a book that stands forth as the first complete history of alchemy, told by the Amherst professor of Chemistry.

Play No Favorites

These books are but part of the whole list of Columbia University Press publications. You will find them all by author, or title, or under the subjects of their contents—and with the full table of contents, and, in the majority of cases, a concise, impartial description — in *Columbia Books* and its supplementary Seasonal Announcements.

A Scientific Bibliography

Columbia Books is your best way for saving time and energy in locating a large portion of American books of information that will be profitable for you to read, or know about. With every copy, Columbia University Press supplies a one-dollar rebate coupon, good on your purchase of any Press publication, whether at a bookstore or direct from the Press. *Columbia Books* costs exactly one dollar, payable in advance, unless you choose to get it for nothing—in the way indicated below.

Columbia University Press
2960 Broadway, New York City

Kindly send me, for payment enclosed* ( ), C.O.D. ( ), charge to my account ( ), the item marked below.

.....**HALL, Scientist in the Early Republic ($2.50).**

.....**HOPKINS, Alchemy ($3.50).**

.....**THORNDIKE, History of Magic (Vols. III and IV, $10.00—not sold separately).**

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SCIENCE NEWS

Science Service, Washington, D. C.

THE ANALYSIS OF LIGHT

EXPECTED to be of tremendous assistance in the analysis of light, two new instruments are being developed at the Massachusetts Institute of Technology by Professor George R. Harrison, director of the spectroscopy laboratory. Light analysis, or spectral analysis, is one of the most powerful of modern scientific weapons.

One of these instruments automatically measures and computes the wave-lengths of spectrum lines, which are the separate bands that appear when a beam of white light is spread out by a prism or grating into an artificial rainbow. The other instrument, called an interval sorter, determines the energy of atoms and molecules from the spacing of these spectrum lines.

In measuring a spectrum by previous methods, the observer estimates by eye the distances of the spectrum lines from some standard line, using a delicate machine known as a comparator. For a spectrum photograph containing many of these lines the task might easily require days or even weeks. To avoid errors caused by temperature changes in the mechanism, each plate had to be measured several times and the results reduced by complex calculations.

Although the new machine for measuring wave-lengths is still in the process of development, it makes measurements twenty times faster than by the conventional methods, and the results are twice as accurate. Further development is expected to make it 200 times faster than the old method. A beam of light supplants the human eye in recording the measurements by means of a photo-electric hook-up.

The interval sorter speeds up the process of determining energy levels of spectra several hundred times, eliminating computations which in some instances total 100,000 in a single analysis. Professor Harrison's machine makes automatic computations at the rate of 50,000 a minute, sorting out the wave-length intervals and recording them photographically at the same time.

THE CONSTITUTION OF THE SURFACE LAYER OF THE MOON

VOLCANIC ash and pumice. That is what the moon's surface is made of, if a committee of the Carnegie Institution of Washington has the correct evidence. Green cheese has never been considered moon material except in nursery rhymes, but investigators have wondered whether the lunar landscape is made of dark, solid rocks like most of the earth's surface.

The reflected sunlight that reaches earth one and a quarter seconds after leaving the moon brings a message to scientists. Because it is relatively little polarized or set to vibrating in one direction, as it would be if it came from dense dark rocks, it is concluded that the moon rocks are like the light, translucent rocks and materials found around volcanoes here on earth. The rapidity with which the moon drops in temperature when the eclipse shadow of the earth sweeps over it also argues for a moon surface largely made of silica and produced by volcanism.

While the moon was once the scene of great catastrophic movements and crustal movements, it is "dead" in comparison with the earth. It is without air and water, and no protective blanketing atmosphere softens the impact of the sun's rays and prevents the escape of heat. Temperature fluctuates violently. Moon craters make earthly volcanoes dwarfs in comparison. Moon mountains are unlike earth mountains and geologists have difficulty understanding them. Moon mountain heights reach 25,000 feet and the deepest crater has a depth of 24,000 feet.

Four miniature moons have been prepared by Dr. F. E. Wright, of the Geophysical Laboratory, chairman of the committee to facilitate the latest study of the moon. These globes are the first spherical photographic negatives, specially coated and fashioned for this research.

THE DEFLECTION OF COSMIC RAYS IN ELECTRIC FIELDS

A METHOD of analyzing cosmic rays—by deflecting them in intense electric fields—has been achieved by Dr. Ernst Lenz at the Physical Institute of the Technical College at Stuttgart. Dr. Lenz is a pupil and colleague of Professor Erich Regener, the cosmic ray authority.

If cosmic rays consist, in part, of electrical particles such particles should be deflected by both strong magnetic and electric fields. The deflection by magnetic fields has long been known but hitherto investigators have had difficulty in detecting the electric field deflection.

Using three Geiger-Muller counters to line up the axis of a corpuscular cosmic ray and a fourth counter to measure the angle of deflection, Dr. Lenz found that fields of 700 volts per centimeter were capable of deflecting the weaker and softer rays about four tenths of an inch.

Very intense electric fields of 70,000 volts per centimeter were necessary to deflect the most penetrating rays. For the soft rays the displacement indicated a preponderance of particles bearing a positive charge of electricity. The strong, penetrating rays, however, showed a preponderance of particles carrying a negative electric sign.

From the deflection observed, it was possible to estimate the energy of the weak and strong components of the cosmic rays. The weak particles possessed an energy equivalent to 10,000,000 electron volts and the strong, penetrating particles energies of 2,000,000,000 volts.

The new method, Dr. Lenz indicates, "is considerably more convenient for the investigation of cosmic radiation than the use of magnetic fields."

Dr. Lenz's results appear in the British science journal *Nature* in the last issue, which has not yet reached America.

With reports from Germany that scientists have al

THE SCIENTIFIC MONTHLY

EDITED BY J. McKEEN CATTELL

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THE EFFECT OF X-RAYS ON TISSUE REGENERATION. DR. ELMER G. BUTLER.

JOHN WESLEY POWELL. DR. WILLIAM H. HOBBS.

IS A SCIENCE OF EDUCATION POSSIBLE? PROF. FREDERICK S. BREED.

A SCIENTIFIC APPROACH TO EMOTIONAL PROBLEMS. DR. J. McKEEN CATTELL.

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- RACE CROSSING AND HUMAN HEREDITY. MELVILLE J. HERSKOVITS.
- BEE BEHAVIOR. JAS. I. HAMBLETON.
- NEW INDUSTRIES FOR OLD. DR. E. R. WEIDLEIN.
- CAN YOU LIVE WITHOUT WATER? ABEL WOLMAN.

EVOLUTION OF A MODERN DEFINITION OF THE MATHEMATICAL TERM "GROUP." PROF. G. A. MILLER.

LIGHTNING DISCHARGES TO GROUNDED CONDUCTORS. PROF. J. C. JENSEN.

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- THE BIOLOGY OF PRIMITIVE HUMAN SOCIETIES. DR. E. A. HOOTON.
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last been able to deflect penetrating cosmic radiation by the use of strong electric fields it is revealed that research at the Bartol Research Foundation laboratories has been directed along similar lines in the past.

Professor W. F. G. Swann, director of the Bartol laboratories, when informed of the achievement of Ernst Lenz at Stuttgart in bending cosmic rays nearly half an inch with electric fields, pointed out that in April, 1933, he and Dr. W. E. Danforth, Jr., reported to the National Academy of Sciences preliminary results of similar work. No detailed report of the work has yet been published by Professor Swann.

THE SOUTH DAKOTA PLESIOSAUR SKELETON

SOUTH DAKOTA'S fossil-rich mountains, the Black Hills, have yielded a new and notable prize, a well-preserved fossil skeleton of a plesiosaur, or seafaring dinosaur. The find was made by two geologists of Whitewood, S. D., Charles C. Haas and his son, Arthur J. Haas.

The skeleton was embedded in a stratum of Cretaceous age—perhaps fifty million years old—in which no remains of this group of giant reptiles had ever before been discovered. It has been identified as the saurian species known to scientists as *Trinacomerum bentonianum*.

The discoverers were told by Curator S. C. Simms, of the Field Museum, Chicago, that "only five or six plesiosaur skeletons of any genus are on exhibition in any museum in America, and none of this genus, nor any from this formation."

The plesiosaurs were structurally well adapted for a life of submarine piracy in the high seas. The body was streamlined, propelled by four wide paddles, which were their modified legs. Astern the body tapered off to a short, thick tail. The neck was long and snake-like, bearing a narrow head like that of an enormous bird, with a long beak lined with sharp, alligator-like teeth.

The specimen found by the Messrs. Haas will have a total length of about 34 feet when fully restored, they estimate. It lay on its back, its parts all "in line," with very little scattering of the bones. Adjoining rocks bear material that may prove to be parts of its skin.

An interesting part of the find consists of a number of rounded pebbles of hematite, an iron mineral, which appear to have been the creature's "gizzard stones" for dinosaurs of old, like chickens of to-day, chewed their food after swallowing, by means of an internal pebble mill.

The skull of the Haas plesiosaur measures 28 inches in length, 12 inches in width and 7 inches high. There are 15 teeth to each side of the jaw, cone-shaped, smooth-surfaced and very sharp. The ten-foot neck has 13 vertebrae, the largest being five inches in diameter and six inches long.

One flipper, which seems to be one of the rear pair, has been measured. It is a foot wide and four and one half feet long. The largest rib is three feet long and one and one half inches wide.

Other fossil remains found in the same formation include some twenty different kinds of shark teeth, the remains of a number of squid, and two six-inch footprints of web-footed saurians. There were also a few leaf-fossils and pieces of wood.

VITAMIN C AND THE RHEUMATIC HEART

IT is much too soon to advocate oranges, tomatoes and cabbage for those who fear rheumatic heart trouble; but the U. S. Public Health Service reports experiments at the National Institute of Health in which "encouraging results have been obtained" linking the production of rheumatic-like heart lesions with vitamin C deficiency in guinea-pigs.

Seizing upon the suggestion of University of California scientists, Drs. James C. Rinehart and Stacy R. Mettier, that a state of undernourishment approaching scurvy may contribute to the development of rheumatic heart disease, Dr. A. M. Stimson, of the federal health bureau, conducted research which seems to link the two conditions.

With characteristic caution, he says that "it can not be stated that scurvy is a factor predisposing to rheumatic infection," but adds that the results of his research justify going further in studies of the apparent relation between the two conditions.

Of course, it may be months or years before the discovery can be applied to human beings. Many additional laboratory and field investigations need to be conducted, Dr. Stimson says. Nevertheless he has obtained the following positive and "encouraging" results:

Guinea-pigs were given scurvy by withholding vitamin C from their diet. They were then inoculated with hemolytic streptococci, "germs" thought to play a rôle in causing rheumatic heart disease. The animals developed heart lesions "somewhat comparable" to the most typical lesion of rheumatic disease found in man. Guinea-pigs fed on diets lacking vitamins but not lacking vitamin C did not develop these typical lesions after inoculation with the streptococci.

THE CAUSE OF "WORDBLINDNESS"

DIFFICULTIES in reading, or partial "wordblindness," may be caused by a condition in which the individual prefers neither the right nor left hand and eye, or in which the preferred hand is on the opposite side from the preferred eye, according to a theory being developed by Dr. Walter F. Dearborn and his associates at the psycho-educational clinic at the Harvard Graduate School of Education. "Wordblindness" is a term which has been used to describe and to account for the absence of reading ability or "alexia." The term "dyslexia" is used to describe somewhat lesser degrees of difficulty in learning to read.

Dr. Dearborn's theory represents a distinct departure from the belief that the disability is due to defects in the cerebral areas or controlling centers of the brain. He suggests that a more likely explanation may be found in such objective symptoms as reversals in letters and word forms such as in reading "saw" for "was," "tog" for "got" and "broad" for "board."

"It appears," says Dr. Dearborn, "that in order to avoid difficulties in reading and writing, one should be

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either left-eyed and left-handed or right-eyed and right-handed, preferably the latter. Difficulties appear especially in children who have been changed over in handedness or whose one-sidedness or later dominance has never been well established.''

Until recently, research on this subject has centered about the supposition that difficulty originated in inherited defects in the visual and auditory ''centers'' of the brain.

After investigations of more than 100 cases, Dr. Dearborn came to the conclusion that knowledge of the defects of the brain centers is very vague and limited. The evidence he gathered points directly to sensory and motor difficulties which induce habits interfering with reading power. He states that the structural basis for some of these difficulties may be inheritable.

In a comparison between 100 cases of dyslexia and 376 cases of normal readers selected from the public schools, Dr. Dearborn found that 81 per cent. of the word-blind subjects were of either left dominance in hands and eyes; crossed dominance, such as right eye with left hand; or of mixed dominance—that is, both hands and eyes of equal controlling strength. Only 51½ per cent. of the normal students had left, crossed or mixed dominance.

Dr. Dearborn emphasizes the fact that a condition of left, crossed or mixed dominance does not necessarily bring on dyslexia and is only one of several possible causes. The large majority of persons so equipped are either not unduly troubled or manage to overcome the attendant difficulties.

The key to the difficulties, according to Dr. Dearborn, is the fact that in the English language the movements of the hand and eye are from the left to the right. This, it has been well established, is the easiest and most natural movement for the right-handed person, away from the center of the body. Left-handed and left-eyed children have a preference for the opposite direction, that is, from right to left. Consequently when such subjects are confronted by flash reading tests, the tendency is for them to see words and letters backwards as ''form'' for ''from,'' and ''on'' for ''no.''

ITEMS

APPARATUS for making oxygen squeeze itself out of the air at temperatures of 297 degrees below zero Fahrenheit was demonstrated before the recent St. Louis meeting of the American Physical Society by Professor Charles T. Knipp, of the University of Illinois. By cooling one spot of a glass container of colorless oxygen gas with liquid air at a temperature of minus 310 degrees Fahrenheit he was able to turn the gas into its liquid form and obtained a pale blue oxygen fluid. Liquid air is cold enough to liquefy oxygen, Professor Knipp pointed out, because four fifths of all air consists of nitrogen which only liquefies at 319 degrees Fahrenheit below zero.

THE working of small unmanned stratosphere balloons sending back continuous reports by radio from altitudes of over 17 miles was described by Professor J. M. Benade, distinguished Indian physicist from Forman Christian College at Lahore, India, before the meeting of the American Physical Society. Cosmic ray intensity is transmitted by a special electrometer measuring the electrification of air molecules in the apparatus. Gradually the air ions formed by cosmic rays charge up the electrometer which is arranged so that for a given constant charge it will energize a photoelectric cell. The photocell current then cuts off the radio transmitted. The frequency with which the incoming signal is interrupted is, therefore, a measure of the cosmic ray intensity at the point in question.

CERTAIN perennial weeds can be made to ''drink'' poison through their tops. This recent finding is being taken advantage of by the California State Department of Agriculture in the eradication of the noxious weed known as camel thorn. Brought into the state from southwestern Asia, apparently in alfalfa seed, the weed has caused alarm because it does not respond successfully to ordinary methods of control. Under the direction of W. S. Ball, chief botanist, the tops of old plants are bent over and placed in quart or pint jars filled with a weak solution of arsenic, care being taken not to break the stems. The poison is carried into the root system by capillary action. Death follows not only for the plant treated but also for others growing from the same root system. Every few days the jars are filled with fresh poison and moved to other plants. The solution used is a one per cent. strength of sodium arsenite or some other arsenical that is readily soluble in water. Farmers who have used the treatment experimentally against field bindweed, or wild morning-glory, report good results if the late summer when vines are mature. Care must be taken to keep grazing stock away from treated plants.

LEATHER from dolphin stomachs is the latest achievement of Soviet chemists. In their search for new sources of leather and leather substitutes, the chemists have found that dolphins—sea-going mammals and small relatives of the whale—have stomachs that provide suitable material for women's and children's shoes, and various haberdashery articles. Dolphin leather will be manufactured at the leather works in Tagan Rog, Northern Caucasus. The method was worked out at the Azov-Black Sea office of the leather trust. Soviet chemists have been actively working on leather materials, since the second five-year plan calls for increased shoe production. One hundred million pairs per year is the goal to be attained, compared with present output of this million. Twenty-one new factories are to be constructed for the purpose.

WESTERN farmers who had a fight on their hands with the chinch bug last summer will find that it was only a skirmish, compared to the battle they will be up against in the summer of 1935. The hordes of tiny pests now going into winter quarters in scarcely diminished numbers. Even if the coming winter is severe there will undoubtedly be enough survivors to breed a crop plague of calamity proportions, necessitating heavy expenditures in money and man-power to save the grain.

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A study undertaken by The Committee on Psychiatric Investigations, National Research Council, and supported by a grant from The Carnegie Corporation. Members of the committee: MADISON BENTLEY, Chairman, Cornell University, and E. V. COWDRY, Washington University. 390 pages, $4.00

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SCIENCE NEWS

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THE COMPOSITION OF THE "GREAT RED SPOT" ON JUPITER

A GREAT island of solid, frozen ammonia floating on a sea of liquid hydrocarbons, like ethane, ethylene and acetylene, is suggested as the structure of the long-known, mysterious "great red spot" observed on the surface of the planet Jupiter. The hydrocarbon ocean may be as large as the planet itself, which is 34,800 miles in diameter. This postulate is presented by Dr. Arthur Adel, of the University of Michigan, and Dr. V. M. Slipher, of Lowell Observatory, in a report to the *Physical Review* describing research which provides indications of the nature of the atmosphere on the major planets Jupiter, Saturn, Neptune and Uranus.

The largest constituent of the "air" of these distant planets of the solar system is methane, each molecule of which is composed of an atom of carbon and four atoms of hydrogen. Ammonia has previously been detected on Jupiter and Saturn. The ammonia island suggested by Drs. Adel and Slipher could be created by the extremely low temperatures of the distant planets because they are so far removed from the source of the earth's and their own heat—the sun. Of the major planets, Jupiter is nearest to the sun, but is still 483,300,000 miles away, over five times as far removed as the earth. Neptune, most distant of all major planets, is 2,791,600,000 miles away from the sun. The presence of methane in the atmosphere of the large planets indicates the temperature is not lower than 265 degrees Fahrenheit below zero, which is the boiling point of methane. Yet this is low enough to freeze and liquefy such gases as ethane, thylene and acetylene.

A search for other gases, according to Drs. Adel and Slipher, "leads to the conclusion that the other hydrocarbons, if they are present at all in the atmospheres of the giant planets, must exist only in traces relative to the amount of methane present. Presumably, these hydrocarbons as well as many others exist below the atmospheres of the giant planets. The unanchored motion of Jupiter's Great Red Spot suggests that it is an island of solid hydrocarbon or ammonia floating in a vast hydrocarbon ocean as extensive as the planet's surface itself."

THE POURING OF THE SECOND 200-INCH MIRROR

BLINDED by light from white-hot glass at a temperature of 2,800 degrees Fahrenheit, scientific men and reporters watched, for almost seven hours, great ladles transport 40,000 pounds of glass from the melting furnace to the mold for the new 200-inch telescope mirror which eventually will be placed in the new observatory of the California Institute of Technology on Mount Palomar. Dr. F. G. Pease was present to represent the Mount Wilson Observatory.

As samples of the glass being poured were shown by officials of the Corning Glass Works it was learned that the secret formula used has been changed slightly since the first attempt last March. When the disk poured in March was cooled for examination the glass was a deep turquoise blue. The twenty tons of glass poured in the present operation in 400-pound ladlefuls is highly transparent and crystal clear. The pouring was termed a "complete success." The disk will take eleven months to cool to room temperature.

While the color of the glass makes little difference when used in a mirror which eventually will be coated with silver, or perhaps aluminum, the great transparency of the present type glass would be significant for lens telescopes where the stellar light must pass through the glass. The largest lens, or refractor, telescope in the world, at the Yerkes Observatory of the University of Chicago, is but forty inches in diameter.

THE VITAMIN B REQUIREMENTS OF MAN

WHAT is believed to be the first exhaustive study of any of the vitamins from the point of view of how much a human being needs has been made at Yale University by Dr. George R. Cowgill, associate professor of physiological chemistry. Dr. Cowgill has devoted his research to the vitamin B requirements of man and has established a measure by which nutritionists can determine whether an individual's diet contains enough of this important food factor. The results of Dr. Cowgill's study have been published by the Yale University Press for the Institute of Human Relations.

Deficiency of vitamin B in the diet has long been known to be the cause of beriberi, a disease which constitutes one of the most serious medical problems in the Far East. The greatest significance attaching to vitamin B for people living in North America is the fact that it may be a cause of various chronic conditions summarized under the vague term "ill-health." In these instances the shortage of the vitamin may not be great enough to result in manifest beriberi, but sufficient to produce a complication difficult to recognize and one which therefore escapes treatment. Various gastrointestinal disorders, such as gastric ulcers and colitis, can be related to vitamin B deficiency; certain heart disorders and various neurological conditions may have their beginnings in a diet lacking sufficient amounts of this vitamin.

Body weight and vigor of vital processes (metabolism) were found by Dr. Cowgill to be the most important variables determining vitamin B requirement. In approaching the problem, he made studies of diets associated with beriberi and diets not associated with disease. Among the former were those of families in Labrador, Newfoundland and Calcutta; prison diets in the Far East, notably at Manila, Selangor and Singapore, and diets of various seamen and soldiers. A study of limited diets not associated with beriberi included a variety such as those of American white and Negro families, rations allowed by the German Government for civilians

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during the winter of 1916–1917 and the dietaries of workers on sugar and cacao plantations in the East and West Indies.

He has established that the ratio of the amount of the vitamin to the energy-yielding value of the diet correlated with the body weight and metabolism expresses the adequacy of the diet in vitamin content. Thus the diets associated with beriberi showed an average ratio of 1.74, while in diets where the disease did not occur, the ratio was 2.18. Men require more vitamin B than women. Dr. Cowgill states that "students of the beriberi problem have frequently commented on the fact that this disorder is preeminently a disease of young adult males. As an explanation of this it has been suggested that beriberi is chiefly an 'institutional disease,' that is to say, a disorder found in jails, asylums, groups of laborers and the like, and that the conditions in society which operate to form these groups affect men more than women. The results of the present study suggest another explanation. The formula derived from these quantitative studies indicates that the two most important variables determining the vitamin B requirement are the body weight and the metabolism. Now it is generally known that males have a distinctly higher rate of metabolism than females, and being usually heavier and more active, consequently consume greater quantities of food. Therefore, males have a higher total energy exchange per day. Under conditions where the vitamin B content of the ration proves to be very close to that required by the organism, there is little or no factor of safety against beriberi, and this sex difference in total metabolism may be the chief factor determining whether beriberi shall develop. Under such circumstances it is obvious that the males should be more liable to the disease."

THE ISOLATION OF A PROTEIN DERIVATIVE FROM THE TUBERCLE BACILLUS

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A GREAT advance in medicine's warfare on the great white plague, the obtaining of tuberculosis test material in pure crystals, has been made by Dr. Florence Seibert, of the Henry Phipps Institute in Philadelphia.

For sixty years investigators have been endeavoring to isolate in pure form this substance of the tuberculosis bacillus. Tuberculin allows the making of a simple skin test to tell whether or not a person or animal has tuberculosis. The new purified substance will be of immediate application to human patients.

It has been known for 60 years that this substance was in the TB "germ" and it has been used in tuberculin tests on man and in vast programs of tuberculosis eradication in cattle to insure a safe milk supply. But it has never before been available in pure form.

The isolation of this new substance, called the purified protein derivative of the tubercle bacillus, may be likened to getting out of the pancreas pure crystalline insulin for treating diabetes. Using the old tuberculin would be like using a preparation of the whole pancreas to treat diabetes. The insulin would be there, but so would many other substances. Old tuberculin contained the tuberculosis detective, but it also contained many other things.

To produce this important protein substance, tubercle bacilli were grown on an inorganic medium, and by special chemical methods the pure crystalline substance was isolated. Dr. Seibert has reported technical details of the isolation in the *American Review of Tuberculosis*. Her work was done under the auspices of the medical research committee of the National Tuberculosis Association, largely supported by Christmas seal sales.

A PROPOSED SUBSTITUTE FOR MORPHINE

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AFTER years of painstaking research, investigators have produced a new derivative of morphine in the course of experiments directed toward the discovery of a non-addicting form of morphine. Dihydrodesoxymorphine-D is the name of the new drug. It was made by Dr. Lyndon F. Small, research chemist at the University of Virginia. It is ten times as effective as morphine in relieving pain.

Given as a substitute for morphine to persons addicted to the latter drug, the new product satisfied the cravings of the addicts and relieved the painful abstinence symptoms that follow withdrawal of morphine. This indicated that it also might be habit-forming.

Tests with monkeys and other animals indicate that these animals develop tolerance to the new drug as they do to morphine. It is not certain, however, that experiments on monkeys are a correct index of the new drug's addiction or habit-forming property for man.

The final test of this point is now about to be made. Patients suffering from severe cancer and advanced tuberculosis are sure to become addicted to morphine, because that is the only drug which will control their pain and cough. A group of such patients will soon be given the new drug instead of morphine to relieve their suffering. If they fail to develop addiction to the new drug, dihydrodesoxymorphine-D will be hailed as the long-sought, safe substitute for morphine, and possibly as an aid in the prevention of narcotic drug addiction. If it can be used in the case of persons already addicted to narcotic drugs, it might aid in their "cure."

Since Dr. Small can produce only a limited amount of the new morphine in his laboratory, he has patented his discovery and given the patent rights to the Secretary of the Treasury. The commissioner of narcotics is now able to license manufacturing firms to produce enough of the new drug to complete the clinical trials.

The discovery of dihydrodesoxymorphine-D was the result of a concerted attack on narcotic drug addiction by several groups of scientists working under the guidance of the National Research Council. Cooperating with the National Research Council's committee have been the U. S. Public Health Service, the Narcotic Bureau of the U. S. Treasury, the University of Michigan and the University of Virginia.

At the University of Virginia a research laboratory

was established under Dr. Small's direction for chemical analysis and synthesis of alkaloid substances related to or similar to morphine. Because few American chemists had worked on alkaloid chemistry in the past twenty-five years, it was necessary at the start of the work to import chemists from Europe. Dr. Small himself spent two years in narcotic research in Europe. The "imported" chemists who have worked with him are Dr. Erich Mosetting and Dr. Alfred Burger.

At the University of Michigan another research laboratory was established under the direction of Professor C. W. Edmunds and Dr. Nathan B. Eddy, for biological testing of the narcotics and their substitutes. All clinical work is being done under the direction of Dr. Walter Treadway, chief of the division of mental hygiene of the U. S. Public Health Service. Funds for the work are being provided by the Rockefeller Foundation.

THE FOSSIL EGG FROM TEXAS

(Copyright, 1934, by Science Service)

THE world's oldest fossil egg, approximately 225,000,000 years old, has been found in the Permian Red Beds, an exceedingly ancient geological formation of north central Texas, by the recently returned expedition from the Harvard University Museum of Comparative Zoology.

The egg, three inches long and rusty in coloring, is more than twice the age of previously known specimens, the famed dinosaur eggs of the Gobi Desert being about 100,000,000 years old and the oldest known to science previous to the present discovery. It is one of the most primitive eggs ever laid on land. Prior to that time animal eggs had always been deposited in water, a feature retained from the fish ancestry of the amphibians. Unhatched, and preserved with but little distortion, the fossil gives an accurate conception of the egg's original shape and also of the character of the shell, which is slightly cracked in various places. A microscopic study of this shell is now under way to determine the structure of the limy covering.

The egg can not be definitely associated with any particular animal, but it is believed to be that of a large lizard-like animal known as Ophiacodon, a creature with an exceptionally large head and short limbs, measuring about six feet from snout to tip of tail. The partial skeleton of an animal of this kind was found near the egg.

ITEMS

USING super-penetrating x-rays with energies equivalent to from 1,500,000 to 2,000,000 volts, Professor F. L. Hopwood, of St. Bartholomew's Hospital in London, announces that the non-electrical particles—the neutrons—have been obtained from the element beryllium. Using these neutrons as bombarding particles, both iodine and bromine have been made radioactive by the artificial means. The half period of the radioactive iodine—its rapidity of decay—is thirty minutes. Two types of radioactive bromine were produced, one with a half period of thirty minutes and another with a half period of six hours. Professor Hopwood's announcement, describing the work that he has carried out with six collaborators in London and Berlin, appears in a recent issue of *Nature*.

STUDIES conducted by the U. S. Public Health Service show that an encephalitis outbreak of the type that occurred in St. Louis and vicinity last year may appear anywhere in the United States at any time. The virus that causes this disease is pretty well distributed throughout the country. When, where and why this low level of infection will flare up into another serious epidemic is not known. Investigations are being made to ascertain what factors determine when an outbreak takes place. A test has been devised that gives a pretty good though not an absolute indication of whether or not a person has been infected with the virus of St. Louis encephalitis, as this type of the disease has come to be known. Numerous healthy carriers of the disease have been detected by this test, according to Dr. J. G. Wooley, of the U. S. Public Health Service's National Institute of Health, who reported to the Washington Branch of the Society of American Bacteriologists. Dr. Wooley reported studies made by himself and two other officers of the service, Drs. Charles Armstrong and R. D. Lillie.

THE fight against smallpox has not yet been entirely won. Statisticians of the Metropolitan Life Insurance Company make this statement in spite of the fact that their figures show there was less of this dread disease in the United States and Canada in 1933 than ever before and that the records for the first seven months of 1934 promise a further drop in the number of smallpox cases. Significant is the fact that fully three fourths of the smallpox cases reported by American states in 1933 occurred in only twelve states whose population is only one fifth of that of the entire country. "Generally speaking, these states are the ones in which popular sentiment has been most opposed to compulsory vaccination." The twelve states are California, Colorado, Idaho, Iowa, Montana, Nevada, Oklahoma, Oregon, Texas, Utah, Washington and Wisconsin. Falling in the same class of above-average prevalence of smallpox during 1933 was the Canadian province of Saskatchewan.

GRAPES from South Africa will be on the United States market for the first time during the coming winter, thanks to a new pest-eliminating treatment and to a regulation of the U. S. Department of Agriculture permitting fruit so treated to enter. This will give vineyard owners in South Africa the market advantage inherent in the fact that the Northern Hemisphere's winter is the Southern Hemisphere's summer, enabling the shipping of "early" grapes for the American Christmas market. The embargo that has hitherto been enforced against South African grapes has been due to the danger of introducing the dreaded insect pest, a fruit fly, into the still-exempt American fruit-growing regions. The new treatment consists in exposing the packed grapes to high temperature for a brief period. This eliminates any flies that may be present but does not damage the grapes.

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SCIENCE NEWS

Science Service, Washington, D. C.

SOME ADVANCES IN THE SCIENCES DURING 1934

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Physics

RADIOACTIVITY was created by an external cause for the first time when Professor F. Joliot and Mme. Irene Curie-Joliot, Institute of Radium, Paris, bombarded boron, magnesium and aluminum with alpha-particles with the result that positrons were given off after the bombardment was stopped. Chemical proof was obtained of artificial transmutation as a result of their production of artificial radioactivity. Artificial production of radioactive elements useful in medicine and superior in intensity to the rays of radium was predicted by them at the International Conference on Physics.

Carbon is made artificially radioactive and delayed production of positrons is produced by bombardment with deutons accelerated with a million-volt tube, was demonstrated by Professor C. C. Lauritsen, R. Crane and W. Harper of the California Institute of Technology.

Artificial radioactivity was produced in graphite (carbon) by bombardment with 600,000-volt protons with the production of positrons by Drs. J. D. Cockcroft, C. W. Gilbert and E. T. S. Walton, Cambridge, England.

Alpha-particles are ejected from lithium at speeds greater than the swiftest radioactively-produced alpha-particles when lithium is bombarded with deutons, Cavendish Laboratory experiments showed.

A way to make common element sodium radioactive by artificial means and yield gamma radiation over twice as penetrating as those from natural sources was discovered by Professor Ernest Lawrence, Drs. Edwin McMillan and Malcolm C. Henderson at the University of California.

On basis of experiments on bombarding heavy uranium with neutrons Professor Enrico Fermi, Italian physicist, predicted the early discovery of a whole series of radioactive elements lying between thorium and actinium in the periodic table.

Artificially produced gamma radiation having penetrating power equal to 3,500,000 electron-volts of energy was reported by Drs. C. C. Lauritsen and R. Crane, of the University of California.

A theory of the origin of the mysterious cosmic rays was advanced by Professor F. Zwicky, of the California Institute of Technology, and Dr. W. Baade, of the Mount Wilson Observatory, which holds that the rays are caused by the sudden flare-up, or bursts of energy, from the type of star known as super-novae.

Cosmic rays were deflected by strong fields for the first time in the laboratories of the University of Stuttgart by Ernst Lenz, pupil of Professor Erich Regener, the cosmic ray authority, indicating that much of the radiation is corpuscular in nature.

For the first time the intensity of cosmic rays has been found to vary with different times of the day, the maximum occurring at noon and the minimum between 9 P. M. and 3 A. M., by Dr. Victor F. Hess, of the University of Innsbruck, working in the Tyrol Mountains, 7,600 feet above sea-level.

Partial annihilation of matter, the building up process whereby heavier elements could be formed from atoms of hydrogen, is responsible for the formation of cosmic rays, according to Dr. R. A. Millikan.

While cosmic rays are now known to consist of a mixture of corpuscular particles and photons of light the particle part of the rays accounts for from 90 to 98 per cent. of the total intensity at the top of the atmosphere, according to the estimate of Dr. T. H. Johnson, of the Bartol Research Foundation.

Plans were announced by Dr. A. H. Compton for extended cosmic ray research with small unmanned free-flight balloons which would transmit by radio the data being obtained in automatic instruments miles above the earth.

Cosmic ray measurements 820 feet below the surface of the Red Sea indicate that a large share of cosmic radiation consists of electrical particles, according to Professor W. F. G. Swann of the Bartol Research Foundation.

Radiation resembling cosmic rays but less penetrating is thrown out by the tops of thunderstorm clouds was reported by Dr. B. F. G. Schonland, South African physicist.

Hardest cosmic rays so far discovered (penetrating more than 800 meters or 2,620 feet of water) were discovered by Dr. Axel Corlin of the University of Lund, Sweden, through experiments in an iron mine.

The formation of positrons from cosmic or gamma rays received support from calculations by Drs. W. Heitler and F. Sauter, of Bristol and Berlin.

Cosmic rays are charged particles, not radiation, Drs. A. H. Compton and R. J. Stephenson, University of Chicago, concluded on the basis of cosmic ray meter records of the Settle-Fordney stratosphere 11-mile high flight.

Evidence accumulated that a trinity of particles, neutron, positron and electron, compose all the matter of the universe.

Following Dr. R. M. Langer's and Dr. Carl Anderson's early prediction, renewed suggestions that there exists a new atomic particle—the negative proton—were advanced by Dr. S. Tolansky of the Imperial College of Science, London, and Professor G. Gamow of the Polytechnical Institute, Leningrad, U. S. S. R.

A new atomic particle—a double weight neutron—was suggested by Dr. M. A. Tuve of the Carnegie Institution in Washington.

Experimental proof of conversion of radiation (cosmic or gamma rays) into matter (electrons or positrons) was questioned by Dr. Carl D. Anderson, California Institute of Technology, who holds that when lead or aluminum is bombarded, rays merely knock out particles already existing in atomic nuclei.

A new source of protons for atomic bombardments, consisting of an electric arc operating in hydrogen at low pressure between an incandescent filament and a metal electrode, was devised by Drs. Edward S. Lamar

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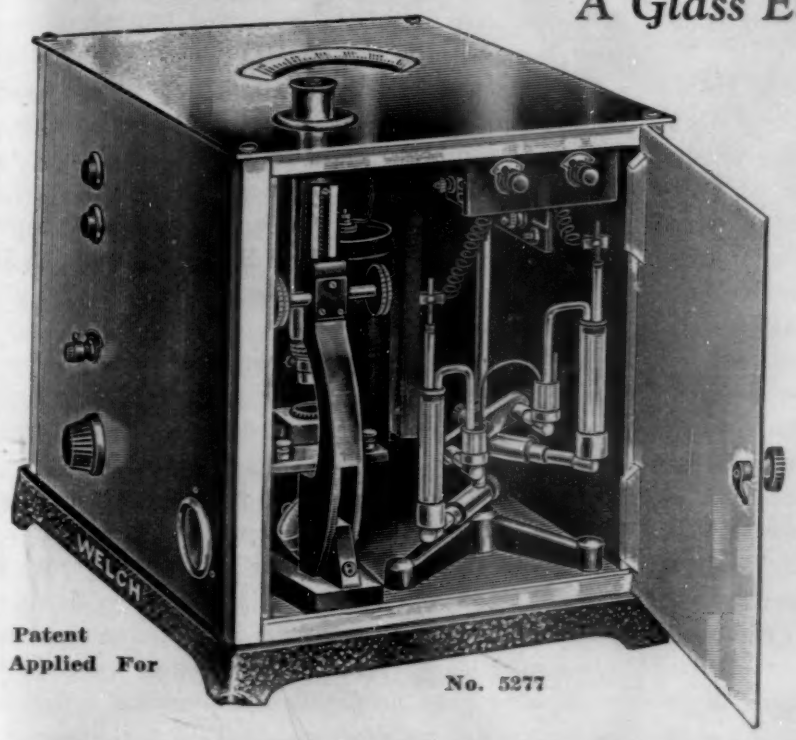

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Fast electrons, as well as cosmic and gamma rays, may give rise to pairs of negative and positive particles when they hit nuclei of atoms, Dr. D. Skobeltzyn, Leningrad, found.

Professor Enrico Fermi of Italy discovered the type of artificial radioactivity in which a negative electron or beta-particle is liberated—as contrasted with the liberation of the positron in the Joliot experiments—by bombarding elements with neutrons.

That the half-life or rate of decay of artificial radioactive materials is different for the same substance when produced in different ways was shown by the experiments of Drs. C. C. Lauritsen, R. Crane and W. Harper, California Institute of Technology, who found that, when they turned carbon into nitrogen by bombarding it with deutons, the half-life of the material was different from the nitrogen made by the Joliots in Paris by bombarding carbon with alpha-particles.

The positron is the shortest lived thing in the universe and dies when absorbed by matter as predicted by the Dirac theory, Professor F. Joliot and Professor Jean Thibaud, French scientists, determined independently.

Using instruments counting individual photons of light, Swiss scientists, Edgar Meyer, M. Schein and B. Stoll, have been able to detect a new band of invisible light in the ultra-violet in the region from 2,400 to 1,900 Ångstrom units.

By free-flight balloon ascensions Professor Erich Regener of the Physical Institute of Stuttgart, Germany, indicated that 70 per cent. of the ozone is below 19.5 miles altitude, much lower than the height previously supposed.

Invention by Professor G. R. Harrison, of Massachusetts Institute of Technology, of two devices for measuring and analyzing complicated spectra are: (1) a wave-length computing machine which automatically prints wave-lengths and intensities with all correction factors directly on a photographic plate, and (2) an interval sorter which performs and sorts 50,000 subtractions of wave numbers per minute.

Analysis of the observations made by American investigators during the Polar Year indicates that the temperature of the region from 62 to 124 miles above the earth is probably in the neighborhood of 80 degrees Fahrenheit.

Small periodic variations in the measurements of the velocity of light were found in the course of extensions of Michelson's experiments at Mount Wilson Observatory, which gave a new average value, 299,774 kilometers per second, but these were attributed not to a real variation in light's speed but to other undiscovered causes.

A new theory of relativity developed by Sir Shah Sulaiman, distinguished mathematician and justice at Allahabad, India, links the classical mechanics of Sir Isaac Newton with the results predicted by Einstein's relativity.

"Photographs" of atoms magnified, in effect, 200,000,000 times obtained by the use of x-rays were exhibited by Professor A. H. Compton and Dr. E. O. Wollan of the University of Chicago.

X-ray studies of the structure of wood fibers reveal that even, soft tone accompanies the non-orientation of the wood fibers in the maple back of a violin, Dr. K. Lark-Horovitz and W. I. Caldwell of Purdue University have discovered.

Heat-absorbing glass which removes 52 per cent. of the "hot" but invisible infra-red rays and which is expected to prove useful for skylights in southern factories during hot summer months, was reported by Dr. Roger S. Estey, physicist of the Electrical Testing Laboratories, New York City, to the Optical Society of America.

Sextants and binoculars can be improved for use under certain light conditions by attaching polarizing prisms, Dr. E. O. Hulbert, Naval Research Laboratory, found.

A precise value for the velocity of sound, 1087.13 feet per second at zero degrees Centigrade was announced by Dr. Dayton C. Miller, Case School of Applied Science, who computed data from big gun firing just after the close of the World War.

By firing a gun into the barrel of a similar gun, Dr. C. Ramsauer, German physicist, developed a method of producing high pressures and high temperatures simultaneously.

The Raman effect of heavy water (containing hydrogen isotope mass two) is different from that of ordinary water, Dr. R. W. Wood, Johns Hopkins University, found.

Production of clear crystals of lithium fluoride transparent to 900 Ångstrom units in the ultra-violet and with practically no variation in dispersion over visible spectrum, have been developed as a practical optical material in large sizes by Professor D. C. Stockbarger of Massachusetts Institute of Technology.

Chemistry

Triple-weight hydrogen, three times as heavy per atom as the ordinary kind, was discovered at the Cavendish Laboratory of Cambridge by Lord Rutherford and Drs. M. L. Oliphant and P. Harteck; at the Department of Terrestrial Magnetism of the Carnegie Institution by Drs. M. A. Tuve, L. R. Hafstad and Odd Dahl; at Princeton University by Drs. Gaylord P. Harnwell, Henry D. Smyth, Walker Bleakney and Philip T. Smith.

Existence of helium of atomic mass three instead of four was reported by Dr. P. I. Dee of Cavendish Laboratory of the University of Cambridge.

Age-long impact of cosmic rays on the earth's surface caused the formation of the rock-like material of the crust out of the nickel-iron core, is the suggestion of Professor Gilbert N. Lewis of the University of California.

A new chemical indicator called "nitrazine yellow" for telling the difference between acid and base solutions at very low concentrations was developed by Dr. Henry Wenker.

Protactinium, after uranium the heaviest of all elements in atomic weight, was successfully isolated independently in the United States by Dr. Aristid Von Grosse, University of Chicago, and in Berlin by Drs. Georg Graue and Hans Kading, Kaiser Wilhelm Institute.

The atomic weight of protactinium, next to the heaviest element known to science after uranium, was measured

as 231 times that of hydrogen by Dr. Aristid Von Grosse and M. S. Arguss, of the University of Chicago.

Professor Enrico Fermi, Italian physicist, reported the production of new material by bombarding uranium, present heavy-weight champion, with neutrons, but later found that what he had mistaken for element number 93 was really a new form of actinium of atomic number 91.

Propane, a normal constituent of liquefied natural gas, can extract a considerable portion of the so-called Pennsylvania type of ingredient of lubricating oil, making a superior oil out of supposedly inferior western oils, according to work carried out by Dr. Ulric B. Bray, of Los Angeles.

Specially prepared calcium sulfate or gypsum, called soluble anhydrite, was developed as a drying agent by Professor W. A. Hammond, of Antioch College, and Professor J. R. Winthrow, of the Ohio State University, useful in dehydrating alcohol and other chemicals.

Isolation in pure crystalline form of a new, very reactive substance, gamma methyl fructoside, from fructose, the sugar of fruits, by Dr. Claude S. Hudson, U. S. National Institute of Health, called in question current chemical views as to the composition of sucrose, the common sugar of commerce.

Citric acid, which makes lemons sour, was extracted commercially from the cheapest kinds of Russian tobacco by Soviet chemists.

A rival for transparent cellulose wrapping material called Pliofilm was made synthetically from rubber which is moisture-proof, elastic and easily sealed by slight heat and pressure.

A new antiseptic, azochloramid, soluble in water and not easily destroyed by heat was reported to the American Chemical Society by Dr. Franz C. Schmelkes and Henry C. Marks.

Commercial extraction of bromine from sea water was achieved at the Wilmington, N. C., plant of the Dow Chemical Company by a method which may have also, as a by-product, the extraction of gold from the water.

Various chemicals which stepped out of the "rarity" class into commercial production by carload lots during 1934 include: (1) Acetamide, valuable chemical solvent; (2) diphenyl oxide, a fluid with high boiling point and chemical stability useful as a heat transfer agent between boiler furnace and high pressure steam in high temperature boilers, which allows cheaper boiler construction; (3) boron carbide, industrial abrasive approaching the diamond in hardness which is made from coke and born in electric furnaces.

A new method of chemical separation of artificial radioactive isotopes from the parent substance was developed by Drs. Leo Szilard and T. A. Chalmers, of St. Bartholomew's Hospital, London, which, for the case of iodine, involves the use of pure iodine vapor to prevent radioactive iodine atoms, formed by the bombardment of ethyl iodide, from returning to the target. The method appears useful for the concentration of man-made radioactive products of atomic number higher than thirty.

Astronomy

Previously accepted dimensions of the Large Magellanic Cloud, nearest of external galaxies, were doubled (not less than 20,000 light years diameter) by studies under Dr. Harlow Shapley of the Harvard College Observatory.

The Milky Way galaxy in which we dwell (about 30,000 light years to its center) is no larger than other galaxies seen as spiral nebulae, Dr. J. S. Plaskett and Dr. J. A. Pearce, Dominion Astrophysical Observatory, Victoria, concluded from a study of the gravitational behavior of the so-called Class B stars.

The Milky Way galaxy was found to be only half as large as heretofore supposed through photoelectric measurements by Drs. Joel K. Stebbins and C. M. Huffer of the University of Wisconsin which verified the existence of dust particles in our galaxy that cause astronomers to misjudge true star distances.

The Milky Way galaxy in which the sun and earth are located may be nearly spherical instead of being watch-shaped as previously supposed, Dr. Harlow Shapley of the Harvard College Observatory reported as the result of Harvard measurements of the cluster type Cepheid variables at large angular distances from the Milky Way.

A photoelectric cell device attached to the 100-inch Mount Wilson Observatory telescope by Drs. Joel Stebbins and Albert E. Whitford showed the Andromeda nebula to be double its hitherto recognized size due to material on its edges detected by the photoelectric cell but "dark" to human eyes; photographs made with Harvard's Oak Ridge patrol telescope extend the bounds of the nebula still further, and bring out evidence that the system is nearly spherical rather than highly flattened.

A vast super-galaxy in the constellation of Hercules was discovered by Dr. E. F. Carpenter of Steward Observatory of the University of Arizona, this "galactic archipelago" being perhaps 1,500,000 light years in diameter.

Great winds (4 to 40 miles per second) blow in the atmospheres of stars, Dr. Otto Struve and Dr. C. T. Elvey, of the Yerkes Observatory, determined from the evidence of spectroscopic phenomena which have puzzled astronomers for years.

Aluminum-coated glass reflecting mirrors were used by Professor S. L. Boothroyd and associates of Cornell, working at Lowell Observatory, to photograph starlight in the extreme ultra-violet, with the object of obtaining information about temperatures and classifications of stars.

Argon was discovered in the atmosphere of distant stars by Dr. W. W. Morgan of Yerkes Observatory.

Zeta Aurigae, a naked eye visible star consisting of a very hot blue star that three times each eight years is eclipsed for a month by a cooler, gigantic reddish companion, was observed intensively in October because of the possibility of determining the composition, pressure and distribution of the outer atmosphere of the red star by the changes in the blue star's light shining through it.

Some wholly unexplained absorption lines, probably of interstellar origin, in the spectra of stars were found by Dr. Paul W. Merrill, of Mount Wilson Observatory.

(*To be concluded*)

The Science Press Printing Company

An article entitled "The Journal *Science* and the American Association for the Advancement of Science," printed in the issue of the journal for October 8, 1926, contains the following paragraphs:

> In this connection acknowledgment should be made to the printers, The New Era Printing Company of Lancaster, Pa., and especially to Mr. Andrew Hershey. In 1893 they were printers of a local newspaper and of local job work. They offered terms much lower than any city printers and maintained the same rates for SCIENCE for twenty-five years. They proved themselves to be excellent printers and in 1920 were printing some fifty scientific journals. After one partner had died and the other two had advanced in years, the business was sold to a promoter, not himself interested in printing. Charges were greatly increased and the printing became less efficient.
>
> Efforts were made to purchase the printing plant with cooperative ownership by the scientific journals that it printed, but these failed, partly because the $300,000 asked included at least $100,000 for the good will in large measure given to the business by SCIENCE, and partly owing to the difficulties of ownership by the societies and institutions that controlled the journals. When the Carnegie Institution was established in 1902, the editor of SCIENCE proposed the organization by it of an office for scientific printing and engraving which could have been made self-supporting, and, as in the case of the Oxford and Cambridge presses, would have rendered valuable service by assured continuity and expertness in scientific printing; but the plan was not adopted.
>
> SCIENCE and the other journals of The Science Press were for a time printed in Utica, N. Y. In 1923 The Science Press Printing Company was incorporated with its office at Lancaster and with the cooperation of Mr. A. E. Urban as general manager and of those compositors, pressmen and proofreaders who had given that city distinction as a center for scientific printing. This company is now responsible for printing SCIENCE and a considerable number of other scientific journals, monographs and books.

As stated in this quotation The Science Press Printing Company was established to print SCIENCE and the other publications of The Science Press, including *The Scientific Monthly*, *The American Naturalist*, *School and Society*, and the Biographical Directories of "American Men of Science" and "Leaders in Education." The composition and press work of these publications show the high standards that are maintained. In order to bring them out efficiently and promptly—for example, the entire contents of an issue of SCIENCE can be put in type in one day and each week during 1933 about 14,000 copies of SCIENCE were printed, bound and mailed in a little more than one day—it has been necessary to have a shop of considerable capacity and to take in other work. The press now prints some thirty scientific and educational journals and series, and has printed many books and monographs.

It may be regarded as a real contribution to science that there should be a plant in which the workers are trained to deal with scientific material. Innumerable commendations of the accuracy of the proofs have been received; to quote only one, the late Professor E. S. Morse wrote to the editor of SCIENCE: "I corrected my first proof a year before you were born and the one I returned yesterday was the first one in my long experience that needed no correction."

It is also an advantage for scientific men to have relations with a company that maintains the same rates for the same kind of work under the same conditions. High pressure selling and competitive bidding—among the causes of the present economic depression which the codes promoted by President Roosevelt are intended to abolish—are thus unnecessary. A scientific man may assume that work entrusted to the press will be done at a cost as low as is consistent with high standards of work and the best conditions of employment for the workers. This is less than the cost of equally good work in large cities where wages and rents are much higher, but it is not so low as for inferior printing or where the welfare of workers is disregarded.

While the press must use efforts to obtain work when the capacity of the shop requires it, its object has been to make it as great an advantage for the scientific man to have work done by it as it is for it to do the work. This policy has succeeded, for employees have not on the average been idle as much as one day a year since the press was established; no employee has been laid off (up to October, 1934) even during the economic depression; wages were decreased by 10 per

cent. for only about fifteen months, when costs of living were lowest; the press has a profit sharing system for employees; all earnings on the stock have been used to improve the plant. The Science Press Printing Company is a business corporation; but it is also a scientific institution. It is conducted on the same principles as the journals that it prints. Its object is the advancement of science—at the same time it must be self-supporting, and it is desirable to make profits that are used to increase its usefulness.

Adequate facilities for the publication and printing of research work are essential for the advancement of science. The cost of conducting a piece of research that deserves publication, counting the time of the scientific workers and all overhead, may on the average be $2,000. The charge for printing by The Science Press Printing Company of a 32 page article or monograph in an edition of 1,000 copies is about $80, say 4 per cent. of the cost of the research. This is less than the interest on the investment, if there is a delay of a year in publication. Ordinary depreciation on machinery is charged at 10 per cent. a year, but it is much larger in the case of scientific research where delay seriously lessens the usefulness of the work and prevents the early recognition of its value. It is most important for science and for scientific men that there shall be prompt and efficient printing and publication of research.

The Science Press Printing Company has had more work offered to it continuously than it could do promptly, but owing to the completion of the printing of "Leaders in Education," followed by the fifth edition of "American Men of Science" (equivalent to 5,000 pages of the usual book) recently completed, it will soon want one or two scientific journals or several books and monographs in order that the full capacity of the shop may be used and all employees be given steady work. This is not only a need of the press but also an opportunity for those who take advantage of it. It is further reasonable to assume that The Science Press Printing Company deserves the support and cooperation of scientific men to the same degree as an institution, a society or a journal that contributes to their welfare and to the advancement of science.

Dr. J. McKeen Cattell was responsible for the organization of The Science Press Printing Company eleven years ago and has been president of the corporation. Since the untimely death in 1927 of A. E. Urban, the first secretary and manager, Jaques Cattell, one of the editors of the last two editions of "American Men of Science," has been secretary and later also vice-president; George M. Houck has been associate manager in charge of the composing room and later manager; Miles W. Eckman has been associate manager in charge of the press room. Inquiries concerning printing should be addressed to the secretary at Lancaster, Pennsylvania.

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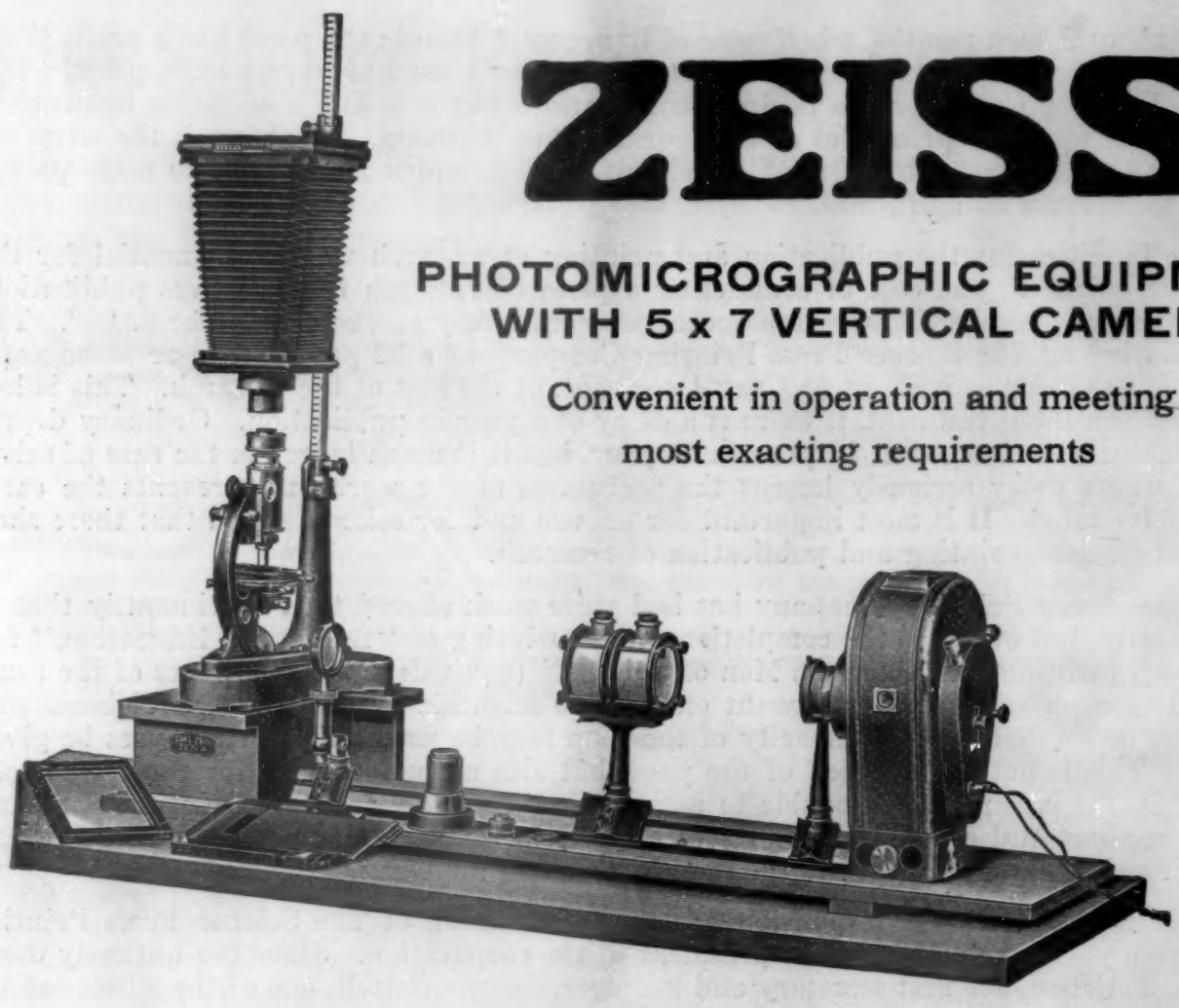

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With translators notes on developments and American practice for the years 1930 to 1933 inclusive

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AT
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EXHIBITION
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1934

DURING the past 15 years good books have appeared in English on latex, plantation practice, the chemistry of rubber and on the technology of rubber, but no thorough treatise on the entire science of rubber has been available. The translation of Memmler's "Handbuch der Kautschukwissenschaft" was prompted by the firm belief that American and British rubber scientists and technologists would welcome a really comprehensive work in English covering not only latex, crude rubber, the chemistry of rubber, vulcanization, and the analysis of rubber, but also embracing such diverse fields as the microscopy of rubber and rubber products, pigment dispersion and the reinforcement of rubber, physics of rubber, botany and plant physiology of the rubber-bearing plants, the aging of rubber, and the specialized equipment for physical testing.

Although a complete revision of the German book has not been attempted, an endeavor has been made to cover many of the important developments of the years 1930 to 1933 inclusive by means of translators' notes. Specific mention may be made of notes on recent developments in synthetic rubber, the compounding and direct utilization of latex, Gutta-Percha (which was not discussed in the German version), recent X-ray work, the thermal and elastic properties of rubber, the electrical properties of rubber (work of the Bureau of Standards), recent theories of vulcanization, the effects of pigments in rubber, and the latest physical testing equipment (with emphasis on that of American origin). A comprehensive chart on the reactions of the rubber hydrocarbon has been included in the English version. The accuracy of the references to the literature in the German book has been greatly increased by careful checking on the part of the translators.

By far the greatest single addition to the German book is the comprehensive bibliography of books and pamphlets on rubber, compiled by Miss H. P. Albaugh, Research Librarian of the Firestone Company. As this bibliography, which lists over 1700 titles, is the most complete one ever published, it should be of very great value to librarians and to workers in the field of rubber.

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SCIENCE NEWS

Science Service, Washington, D. C.

SOME ADVANCES IN THE SCIENCES DURING 1934

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Astronomy

SEVENTEEN hundred hitherto unreported variable stars, 1,000 in the Small Magellanic Cloud and 700 in our own Milky Way, were found during Harvard researches.

The average temperature of the interior of the sun is 12,000,000 degrees Centigrade and the maximum is 21,000,000 degrees, as computed theoretically by Sir Arthur Eddington.

Motion pictures of a 25,000-mile "bomb" shot out from a sun-spot were made by Robert R. McMath and R. M. Petrie, at the McMath-Hulbert Observatory of the University of Michigan, by means of the spectrohelio-cinematograph.

The sun's counter-glow or "Gegenschein" consists of two parts, an inner glow due to a dust ring inside the earth's orbit, and an outer glow due to dust ring outside the orbit of Mars is proposed by Dr. Cuno Hoffmeister of Babelsberg.

Phosphorus, fifty-ninth of the 92 elements to be found in the sun, was identified by Dr. Charlotte E. Moore, of Princeton, using solar spectrograms made by Dr. Harold D. Babcock, of the Mount Wilson Observatory, and phosphorus spectra by Dr. C. C. Keiss, U. S. Bureau of Standards.

A faint diffuse emission line agreeing in position with the green coronal line was found by Harold D. and Horace W. Babcock, of the Mount Wilson Observatory, in spectra of the solar chromosphere taken without an eclipse; the red coronal line was feebly present in absorption, and they found, in the far infra-red, an absorption line of helium and possibly one of ionized helium.

Extreme ultra-violet solar radiation that leaks through the terrestrial atmosphere between the absorption bands of ozone and those of normal molecular oxygen was detected with sensitive photoelectric equipment by Edgar Meyer, Marcel Schein and B. Stoll, of the University of Zurich, observing from Switzerland's Jungfraujoch.

The total solar eclipse of February 14–13, 1934, the paradox eclipse that ended the day before it began because it crossed the international date line, was observed successfully by Japanese and American astronomers from Losap Island in the Pacific.

A change in the magnetic field of the earth during the February total solar eclipse was detected by Commander Akiyosi of the Japanese Naval Hydrographic Office.

Hidalgo, the asteroid that moves like a comet, was rediscovered in October at Simeis Observatory, Russia.

Comets or other objects sighted included: Reinmuth's comet of 1928 rediscovered by Dr. H. M. Jeffers, of Lick Observatory, Encke's comet also picked up by Dr. Jeffers, an unusual object sighted by L. Boyer from Algiers University Observatory, Schwassman-Wachmann's Second Comet rediscovered.

Failure of a brilliant November meteor display made astronomers suggest the earth has lost touch with the densest part of the Leonid meteor swarm.

Unusual meteoric fireballs flashed over New England on September 26 and over Maryland, Pennsylvania and New Jersey on October 17.

Pluto, farthest planet, discovered in 1930, according to Dr. Walter Baade, of Mount Wilson Observatory, is about the size of the moon.

Two white spots on the planet Jupiter were discovered in April, one by a Berlin amateur and another by Professor J. J. Nassau, of Warner and Swasey Observatory in Cleveland.

That Jupiter and Saturn have atmospheres consisting largely of the deadly gases, methane and ammonia, is shown by researches made by Dr. V. M. Slipher of Lowell Observatory, Dr. Arthur Adel of the University of Michigan, Dr. Rupert Wildt of Göttingen and Dr. Theodore Dunham, Jr., of Mount Wilson Observatory.

Life on Venus was pronounced unlikely when Mount Wilson Observatory studies by Dr. Walter S. Adams showed absence of oxygen or water above its dense surface-hiding clouds.

Venus has 10,000 times as much carbon dioxide as the earth, Dr. Arthur Adel, of the University of Michigan, concluded from a comparison of planet and laboratory absorption bands.

The great red spot on Jupiter is a great island of frozen ammonia floating on a sea of liquid hydrocarbons, like ethane, ethylene and acetylene, according to a postulate of Dr. Arthur Adel, of the University of Michigan, and Dr. V. M. Slipher, of Lowell Observatory.

Comets and meteors can be shown with the Zeiss planetarium through use of a new device.

A television-photoelectric scanning of the uneclipsed sun will reveal the corona without waiting for total solar eclipse, is the suggestion of A. M. Skellett, of the Bell Telephone Laboratories.

Aluminum came into use as telescope mirror coating, Dr. John Strong, of the California Institute of Technology, so treating Lick's Crossley reflector and making preparations for aluminizing the Mount Wilson 100-inch mirror.

Scratch-proof telescope mirror coatings were made by Robley C. Williams, of Cornell University, by evaporating a layer of chromium and then a reflecting layer of aluminum on the glass.

The 200-inch telescope progressed as follows:

Two 200-inch glass disks were poured at Corning, N. Y., for the main mirror.

Grinding of the 120-inch flat for testing the 200-inch began at Pasadena, Calif.

Palomar Mountain, northeastward 45 miles from San Diego, elevation 6,126 feet, was selected as the site.

THE JOURNAL OF NUTRITION

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Vol. 9 No. 1 to be issued in January will contain the following articles

W. T. SALTER, P. D. ROBB and F. H. SCHARLES. Liver glycogen from derivatives of glucose. Four figures.

JENNIE TILT and CATHERINE F. WALTERS. A study of the basal metabolism and diet of normal young college women in Florida.

J. M. COLEMAN and R. W. RUPRECHT. The effect of fertilizers and soil types on the mineral composition of vegetables.

M. A. OHLSON and K. DAUM. A study of the iron metabolism of normal women. One chart.

AMY L. DANIELS, M. K. HUTTON, ELIZABETH KNOTT, OLIVE E. WRIGHT, GLADYS EVERSON and F. SCOULAR. A study of the protein needs of preschool children. Three charts.

J. A. KEENAN, O. L. KLINE, C. A. ELVEHJEM and E. B. HART. The stability of vitamins B(B_1), G(B_2) and B_4. One chart.

HELEN S. MITCHELL and WARREN M. DODGE. Cataract in rats fed on high lactose rations. Two figures.

C. A. LILLY, C. B. PEIRCE and R. L. GRANT. The effect of phosphates on the bones of rachitic rats. Three plates.

VAN R. POTTER and KURT W. FRANKE. The effect of diet upon the blood thioneine of the albino rat. Two charts.

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An 85-inch glass disk for the University of Michigan Base Lake telescope and an 82-inch disk for Texas' McDonald Observatory were poured at Corning, N. Y.

The new 40-inch U. S. Naval Observatory telescope made by George W. Ritchey went into service.

A new wide-angle photographic telescope was planned for Lick Observatory.

A new observatory building was completed at Princeton.

The invention of the Schmidt telescope allowed the use of spherical mirror with a slightly figured flat correcting plate instead of paraboloid which is more difficult to make.

Geology and Geography

A new estimate of the earth's age, 1,725,000,000 years, was made by Miss Edith Kroupa, of the University of Vienna, as the result of microchemical analysis of radioactive rock from near Winnipeg, Canada.

Important paleontological finds included two great mass deposits of fossils, one of dinosaurs near Billings, Mont., the other in a German lignite mine, both probably the records of wholesale death in a long-past drought; a "quarry" of horse fossils near Hagerman, Idaho; large numbers of extinct pigs in South Dakota; a nearly complete marine dinosaur near Whitewood, S. D.; fossils of a small horse and a giant mammoth near San Diego, Calif., and the fossil bones of an eagle, in Wyoming.

Two fossil skulls, almost midway between reptiles and mammals, now in the Bloemfontein Museum, S. A., were pronounced one of the most important of all known evolutionary links, by Dr. D. M. S. Watson of the University of London.

Two woolly mammouths, complete with hair and flesh, were found in the age long frozen soil of northern Russia.

A record for deep-sea diving was established on August 15 when Dr. William Beebe and Mr. Otis Barton reached a depth of 3,028 feet in the bathysphere in the waters off Bermuda.

Abyssal submarine canyons off the coast of California were investigated by Professor Francis P. Shepard, University of Illinois, collaborating with the U. S. Coast and Geodetic Survey and several California institutions.

A tremendous canyon, like that of the Colorado, was found in an inaccessible part of Mexico, by a California Institute of Technology expedition under R. T. Moore.

Calculations based on the effects of high-velocity bullets support the theory that Meteor Crater and similar great pits were caused by the instantaneous evaporation of impacting meteorites, as reported by Professor C. C. Wylie of the University of Iowa.

Halemaumau Pit, in Kilauea volcano, broke into a spectacular eruption on September 6.

The city of Tiberias, on the Sea of Galilee, was devastated by a storm and flood on May 14.

Samples of air taken in the stratosphere flight in the U. S. S. R. showed that its composition at great heights is approximately the same as at ground level.

The research ship *Atlantis* conducted a scientific survey of the fabled Sargasso Sea.

An international geographical congress, under the presidency of Dr. Isaiah Bowman, American geographer, was held in Warsaw, August 23 to 31.

The first report of a Land Use Committee, of the Science Advisory Board, who are making a comprehensive scientific study of the country's natural resources, was presented to President Roosevelt on December 1.

Checking the alarming progress of erosion of the nation's best farm, range and forest lands was undertaken as a leading part in the program of public works.

The U. S. Weather Bureau is extending, with the cooperation of the Army and the Navy, systematic daily high-altitude airplane flights to obtain upper-air meteorological data, to use in the air-mass analysis of current weather.

Geologic effects of the great drought included a dust storm that covered half the country in mid-May, notable low levels in rivers and lakes, and diminished activity in many of Yellowstone Park's geysers and hot springs.

There were hundreds of icebergs in the North Atlantic during the spring but none of them got as far south as the main steamer lanes.

Two masses of rock fell off the face of Niagara.

Only three major tropical storms occurred in West Indian waters, but typhoons in the East Indian region were numerous, and several of them highly destructive.

There were 37 earthquakes of sufficient intensity to affect far-distant seismographs, several of them destructive to life, as in India on January 15, in Afghanistan on June 14 and in Honduras on December 2; in Utah a strong quake tore open the earth and produced fountains of brine.

The Soviet Government energetically pushed its program of Arctic exploration.

Severe floods occurred in Poland during July.

An expedition under the leadership of Martin Lindsay crossed from Jakobsshaven on the west coast of Greenland to the vicinity of Scoresby Sound and thence south to Angmagssalik, on what was the real objective of the trip—the exploration of 350 miles of the hinterland of the East Greenland coast.

The city of Nome, Alaska, was destroyed by fire on September 17.

On November 16 a new building of the Scott Polar Research Institute was formally opened in Cambridge, England.

A deed of transfer of the territory of the disputed town of Leticia to Colombia by the commission appointed by the League of Nations was signed on June 19.

A new railroad line connecting Brazzaville on the Congo with Pointe-Noire on the seacoast of French Equatorial Africa was opened during the summer.

A section of the frontier between Libya and the Sudan, not previously demarcated, was defined in an agreement between the British and Italian governments.

Medicine

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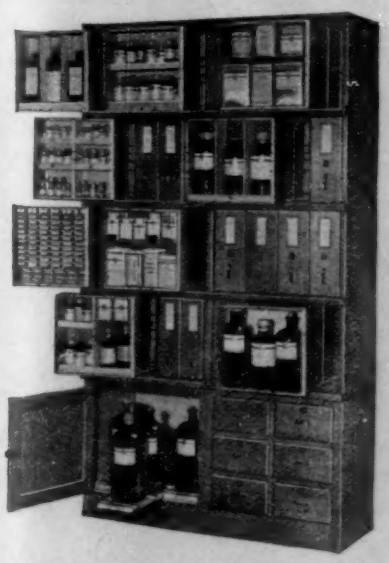

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Dr. A. R. Dafoe, Canadian "country doctor," who struggled against great odds to save the mother and all five baby girls.

Progress in the fight against infantile paralysis was marked by reports of successful use in humans of two vaccines against the disease, one developed by Dr. Maurice Brodie, of the New York City Health Department, and the other by Dr. John A. Kolmer, Temple University Medical School, Philadelphia.

An anti-influenza horse serum, successful in mice, and a method of using these common laboratory animals for influenza studies were reported by Drs. C. H. Andrews, P. P. Laidlaw and Wilson Smith, National Institute for Medical Research, London.

A method of protecting against encephalitis, popularly called "sleeping sickness," but so far applied only to mice, was developed by Drs. Leslie T. Webster and George L. Fite, Rockefeller Institute for Medical Research.

Vaccination against parrot fever or psittacosis was announced by Dr. Thomas M. Rivers, Rockefeller Institute for Medical Research; seven laboratory workers were first to be given this protection which is not considered practicable as yet for the general population.

Isolation and preparation of the pure substance made by the tubercle bacillus that is responsible for the tuberculin skin test in man and animals was announced by Dr. Florence Seibert, Henry Phipps Institute, Philadelphia.

A new explanation of the cause of glandular diseases, such as exophthalmic goiter, which suggests revision in the method of treating these diseases, arose from the discovery by Dr. J. B. Collip and associates at McGill University that the body develops resistance to certain hormones after prolonged administration, probably because of the presence of anti-hormones.

Tremendous precocity of growth and development in successive generations of rats as a result of treatment with thymus gland extract and dwarfism in rats as a result of treatment with pineal gland extract, showing that normal stature apparently depends on proper balance between thymus and pineal glands, was obtained by Drs. Leonard G. Rowntree and J. H. Clark, of the Philadelphia Institute for Medical Research, and Dr. A. M. Hanson, Faribault, Minn.

Cortin, the life-saving hormone of the adrenal gland cortex, was obtained in pure crystalline form for the first time and its chemical formula discovered, as announced, by Dr. E. C. Kendall, Mayo Foundation.

Sterility was cured in a significant proportion of human beings by giving to one or other parent an endocrine gland preparation to make up for hormone deficit, was reported by the late Dr. Allan Winter Rowe, Evans Memorial Hospital, Boston.

The molecular weight and composition of the substance in the thyroid gland, the absence of which causes goiter, was determined by Dr. Michael Heidelberger, Columbia University, New York City.

In the posterior pituitary gland a new factor, probably a new hormone, which controls the activity of the acid-secreting cells of the stomach and may therefore be of interest in connection with the production of stomach ulcers, was discovered by Drs. E. C. Dodds, R. L. Nole and E. R. Smith, Courtland Institute of Biochemistry, London.

Success in the treatment of the mental disease, involutional melancholia, by the sex hormone, theelin, was reported by Dr. August A. Werner and associates at St. Louis University School of Medicine.

A method for and preliminary results of transplantation of living grafts of thyroid and parathyroid gland tissues in human patients were reported by Drs. Harvey B. Stone, J. C. Owings and George O. Gey of the Johns Hopkins Medical School, Baltimore.

That amidopyrine and chemically related headache and pain-relieving remedies are one if not the sole cause of agranulopenia, fatal bone marrow disease which has been on the increase in recent years, Drs. F. W. Madison and T. L. Squier, Milwaukee, reported and research by many other scientists including Drs. Roy R. Kracke and Francis P. Parker, Emory University, confirmed.

A substance in the kidney excretion of expectant mothers that produced a tenfold decrease in the growth of cancers in mice was discovered by Drs. Henry J. Ullmann, Fritz Bischoff and Richard D. Evans and L. C. Maxwell, chemist, Santa Barbara, Calif., Cottage Hospital, the International Cancer Research Foundation, Philadelphia, announced.

The cancer-producing property of mineral oil is related closely to the oil's refractivity constant, Dr. C. C. Twort and J. W. Twort, of the Manchester, Eng., Committee on Cancer, found; selection or treatment of lubricating oils with this fact in mind may result in lessening of skin cancer among textile workers, known as mule spinners' cancer, they suggested.

One of the normal constituents of the body, a bile acid, was transformed by simple chemical means into a cancer-producing substance by Dr. J. W. Cook and associates at the London Free Cancer Hospital under a grant from the International Cancer Research Foundation.

The venom of an Indian snake, *Vipera russellii*, contains a substance which very rapidly clots both normal and hemophilic blood in the test tube and which was successful in checking bleeding after dental and other operations in both normal and hemophilic patients, Dr. R. G. Macfarlane, St. Bartholomew's Hospital, London, and Burgess Barnett, curator of reptiles, Zoological Society of London, reported.

Ability to hasten blood-clotting and thus to control hemorrhage is a property of human milk, fresh or dried, but not of milk from other animals, Professor A. Solé, of Vienna, reported.

Deaths from peritonitis, often fatal infection following abdominal operations, may be reduced by vaccination with a concentrated fraction of bovine amniotic fluid, Drs. Herbert L. Johnson and Edward L. Young, Boston, announced.

A derivative of morphine, dihydrodesoxymorphine-D, made by Dr. Lyndon F. Small, University of Virginia, was patented and will be manufactured under government license for use on patients in order to determine whether it is habit-forming like morphine.

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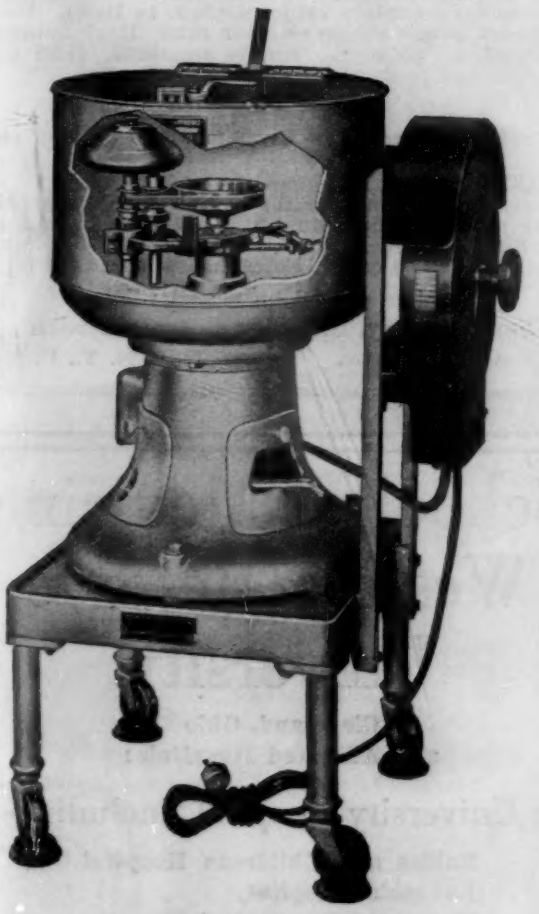

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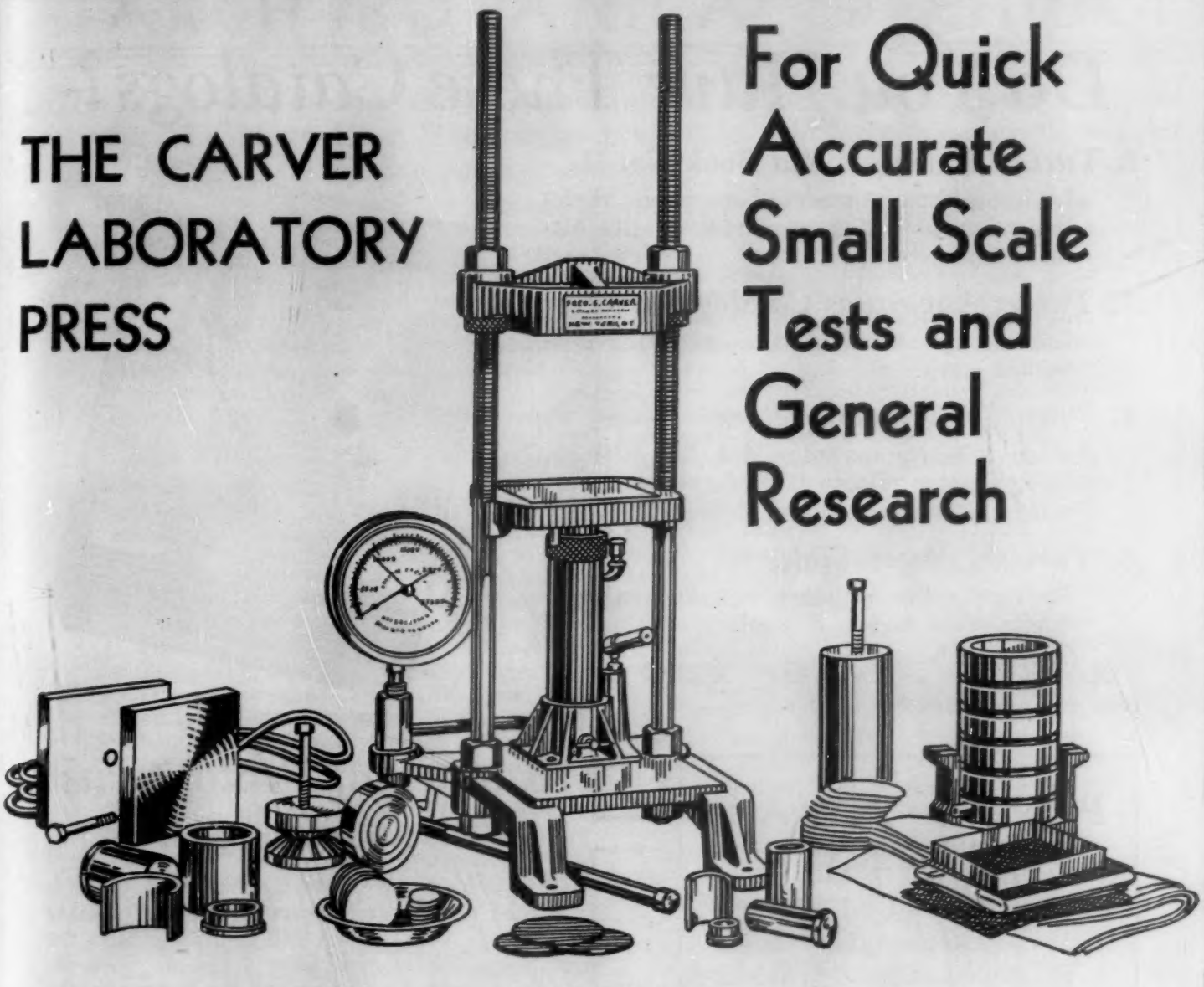

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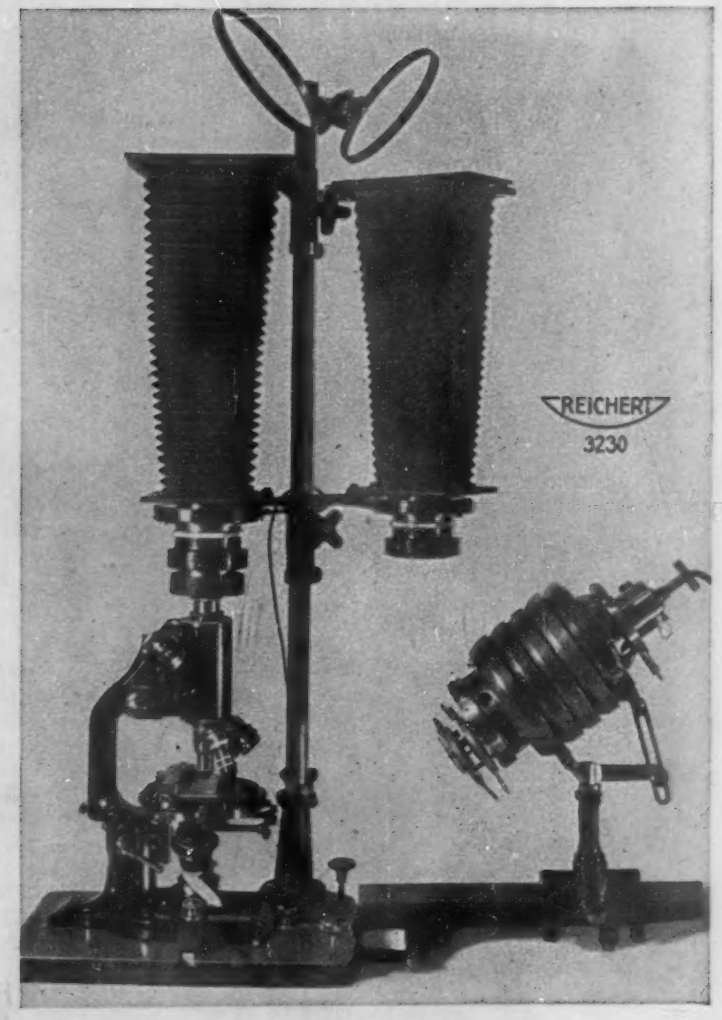

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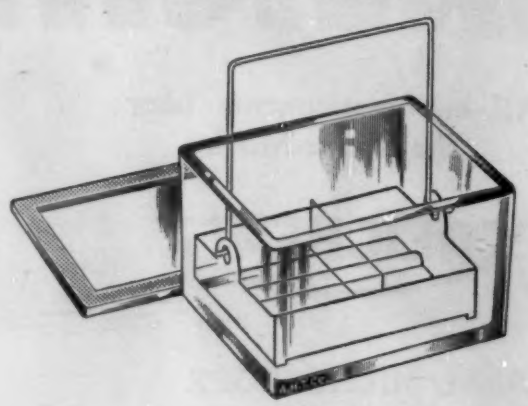

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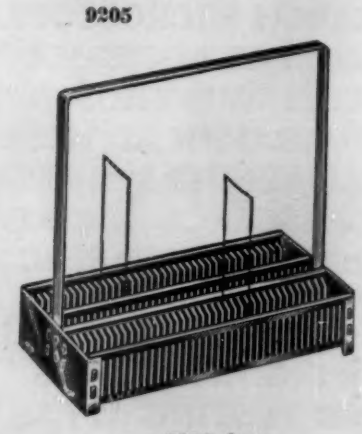

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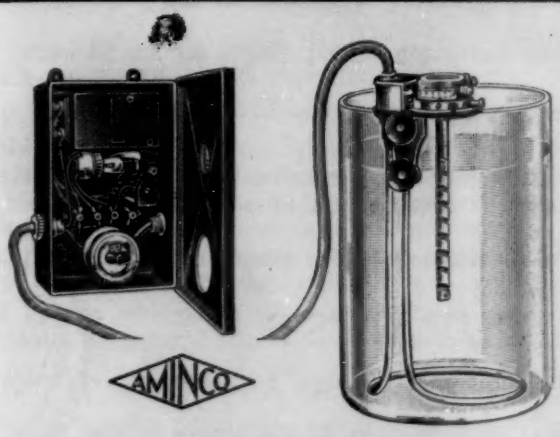

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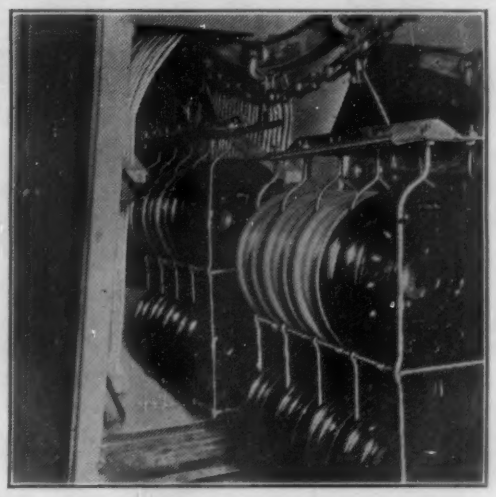

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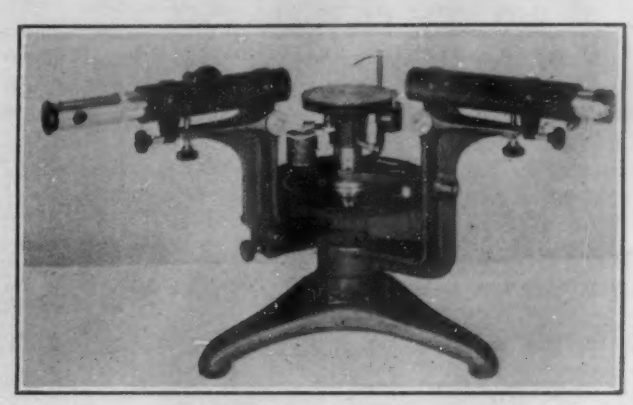

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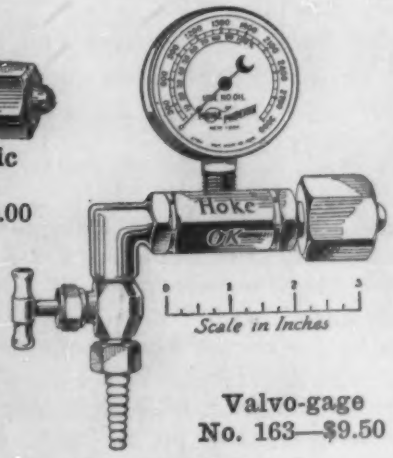

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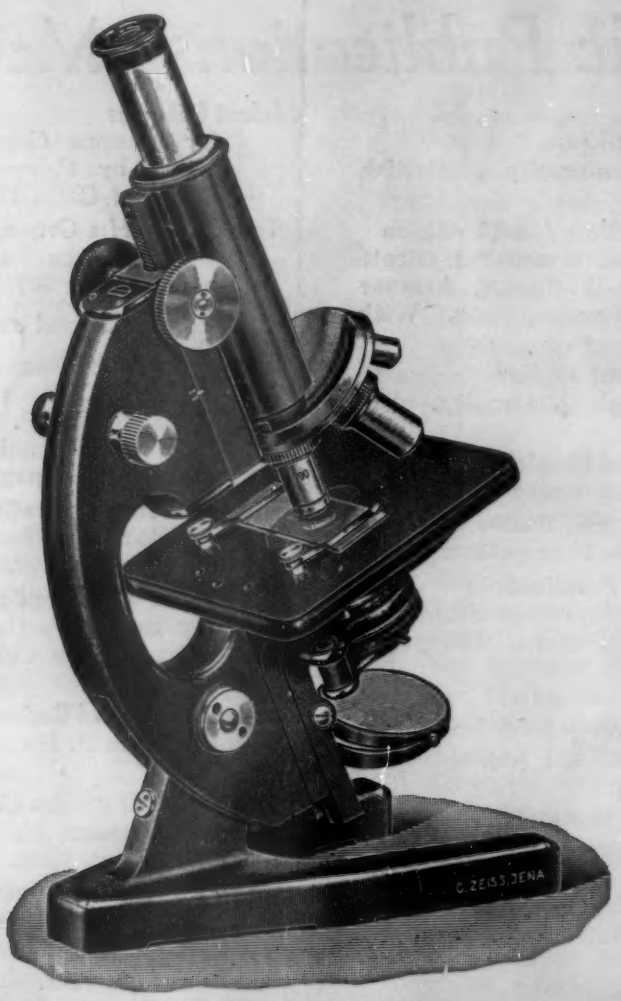

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